THE IRON TRADE REVIEW

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THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

Conferences of representatives of four important Southern companies are being held in New York this week with a view to effecting their consolidation and the prospect of the consummation of an agreement seems to be more favorable than ever, although the failure of former efforts has demonstrated the difficulty of agreeing upon a plan which would be satisfactory to all concerned.

Heavy buying of iron for future requirements has again been the feature of the week's iron trade. In the East sales of basic to leading steel interests, aggregating 80,000 tons, have been reported, and the strength of the Eastern iron situation is clearly indicated by the unfilled orders on the books of the Eastern Furnace Association now amounting to nearly 350,000 tons. A Pittsburg interest purchased 22,000 tons of Northern, Virginia and Southern foundry iron for second and third quarter deliveries. The tonnage taken by Valley furnaces was at a concession from prices that have been ruling and was placed at $15.75 to $15.85, furnace, for No. 2. The Southern iron was placed at $13.50 Birmingham, and the Virginia iron at $14.50 furnace. An Ohio Valley steel interest purchased 6,000 tons of Bessemer for April and May delivery at $15.50 Valley furnace, and the Steel Corporation is negotiating for 30,000 tons of Bessemer for prompt shipment, although deliveries on the recent purchase of 25,000 tons have not entirely been completed. With 92 percent of its furnace capacity in blast, and recent heavy purchases from merchant furnace interests, not sufficient iron is available to meet the Steel Corporation's steel works' requirements. In the Wset pipe makers and other large interests have been feeling the market and show a disposition to figure on third quarter iron. A Wheeling foundry is inquiring for 12,000 tons, and large foundry interests in the Pittsburg district will shortly come into the market for second quarter requirements. The Southern market has been strengthened by recent sales and several large furnace interests have made advances of 25 to 50 cents a ton.

Large sales of malleable and malleable Bessemer have been made. Malleable foundries in the Central West have purchased 20,000 tons and a Cleveland firm has sold about 25,000 tons to Eastern interests.

Rail orderse have been heavy, Wisconsin lines taking 30,000 tons, Rock Island 50,000 and two Western roads 50,000.

Increased pressure is now being brought to bear on leading steel interests by independent manufacturers for heavier shipments of billets and bars, and as the new tonnage taken by the mills in the billet association in the past two months exceeded shipments by 25 percent, increased premiums for early deliveries are looked for. In the East a small tonnage of foreign steel has been taken in at $27.50, tidewater, but in the Central West the large steel interests are doing their utmost to satisfy independent demand and to prevent a repetition of 1902 importations. Steel for prompt shipment is now held at a premium of $4, while for second half delivery an advance of $2 is asked. The special export freight rate on steel products granted in November, 1903, will be discontinued on April 30, as the export movement in the heavier lines has practically ceased.

Plates and structural shapes have been advanced $2, restoring the prices prevailing prior to the reductions made last September. The advance was made in deference to the demands of the Eastern manufacturers, many of them being dependant upon the open market for their steel supply. Shafting has been advanced two points and an early advance of $2 on steel bars is looked for. Iron bars are easier in the West and are offered at a decline of $2 a ton. Advances in blue annealed and galvanized sheets, wire products and merchant pipe have been made this month, and advances in black sheets and tin plate are expected by the trade.

PITTSBURG.

OFFICE OF *The Iron Trade Review*,
429 PARK BUILDING, Feb. 22.

Sales of pig iron in this market the past week aggregate 30,000 tons and the United States Steel Corporation is now negotiating for the purchase of 30,000 tons of Bessemer for prompt delivery, although shipments on the last order of 25,000 tons of February Bessemer have not been completed. The Wheeling Mold & Foundry Co. is in the market for 12,000 tons of foundry iron for extended delivery and other large interests are expected in the market shortly for iron for the second and third quarters. The Standard Sanitary Mfg. Co. purchased close to 22,000 tons of iron for second and third quarter delivery. Of this total about 7,000 tons was Southern, which was sold on the basis of $13.50, Birmingham, for No. 2, for the Louisville plant of that company. Close to 4,000 tons of Virginia iron were purchased at $14.50, furnace, while for the Northern No. 2 the prices ranged from $15.75 to $15.85, at the furnace. The bulk of this iron will come from Valley furnaces and these prices were rather surprising, as it was not believed that the market would develop this weakness. It was believed that $16, furnace, could be readily done, but the lower quotations were unlooked for and indicate that the Valley situation is not nearly as strong as represented. The Valley market is probably the weakest iron market in the country today, and its weakness is no doubt due

to the limited buying on the part of Northern foundries. Northern basic and forge also show some weakness, the former being held at $15.25, furnace, and the latter at $15. Bessemer has recovered somewhat and we note the sale of 6,000 tons for April and May delivery at $15.50, furnace. One large interest in the Valleys having a large stock of Bessemer refused to entertain an offer for a good tonnage at $15.25. It is probable that the Steel Corporation will be compelled to pay $15.50 for its prompt iron, as it is badly needed. Its steel plants continue short despite the tremendous melt from 92 percent of its iron producing capacity now in blast.

Contrary to expectations both plates and structural shapes were advanced last Thursday $2 a ton. Local interests represented at the New York meeting were strongly opposed to an advance, but the Eastern mills demanded that an advance be made, as many of them are compelled to purchase their slabs in the open market and, owing to the premiums asked for steel, were unable to sell their product at the ruling quotations. Prices have now been reëstablished on the same basis prevailing prior to the reduction last September and which ruled officially since 1901. Other advances on finished products made this month include half point or about $1 on merchant pipe, $1 on wire products, galvanized sheets $2, and blue annealed $1, while corrugated roofing was advanced 10 cents a square. The shafting association has just made an advance of 2 points and an advance in tin plate is looked for within a week or ten days. Another advance on wire products is also expected by the trade, while the advances on blue annealed and galvanized sheets will no doubt be followed by advances on black sheets.

This has been a phenomenal month for the whole iron and steel trade, as advances are rarely expected at this season of the year and the manufacturers are surprised at the tremendous tonnage that is finding its way on their books. The steel billet association is booking more orders than it is shipping and deliveries are far behnd. Premiums on prompt steel range from $3.50 to $4 a ton and in the East a small lot of foreign billets was sold at $27.50, tidewater. Of course this price is still too high to permit shipments to the mills in this district and the leading steel interests are doing everything in their power to prevent the importation of steel into any but the Eastern markets. In a few instances shipments of billets have been made to outside consumers, which necessitated the shutting down of some of the manufacturer's own finishing mills, and everything possible will be done to prevent a repetition of the tremendous importation movement of 1902. The leading steel interests have just been notified by the railroads that they will no longer extend special low rates on export steel, these rates going off on April 30. There is little demand for a continuance of this special tariff at the present time, as the steel manufacturers are not seeking new business abroad and are chiefly concerned in the delivery of steel for domestic consumption.

Pig Iron.—The order for foundry iron placed with Valley furnaces for second and third quarter deliveries developed an unexpected weakness, this iron having been placed on the basis of $15.75 to $15.85, furnace. The Southern market, on the other hand, is stronger today than it has been for some time and no better than $13.50 could be done on the 7,000 tons of this 22,000-ton order placed. The Virginia furnaces also showed their strength by adhering to $14.50 or $17.05, Pittsburg, at which 4,000 tons were placed. Bessemer iron is somewhat stronger, and while small lots can be placed at slightly better than $15.50, large lots cannot be placed below this price. One lot of 6,000 tons for equal deliveries in April and May went at this price and it is probable that the Steel Corporation will be compelled to pay this price also for the 30,000 tons wanted for immediate delivery. All of the February iron purchased two weeks ago has already been shipped. At present 92 percent of the furnace capacity of the corporation is in operation. Forge iron is weaker and we note the sale of 500 tons at $15.85, Pittsburg. Basic is held at $15.25, Valley furnace. We revise quotations as follows:

Bessemer, Valley	$15 25 to 15 50
Bessemer, Pittsburg	16 10 to 16 35
No. 1 Foundry	17 00 to 17 25
No. 2 Foundry	16 60 to 16 85
Gray Forge, Pittsburg	15 75 to 15 85
Basic, Valley	15 10 to 15 25
Basic, Pittsburg	15 95 to 16 10

Steel.—Deliveries of steel from association mills are far below the new tonnage that is being daily received, and while the leading steel interests are doing everything in their power to fill the orders of the independent finishing mills and even at the expense of curtailing the steel supply of their own finishing departments, it is evident that steel must soon come from some other source to supply the shortage. A small lot of billets has already been brought into the East at $27.50, tidewater, and while this price is still too high to bring billets into this market, it will require very little increase in the present demand for prompt steel to send premiums upward and to a price where foreign material can be brought in. Prompt billets are offered at a premium of $4 a ton, and for second half delivery the leading mills are asking a premium of $2. Prompt Bessemer and open-hearth billets are held at $25, Pittsburg, and sheet and tin bars at $26 to $26.50. Billets for second half delivery are held at $23. Open-hearth rods are quoted at $32 to $32.50, and Bessemer at $31.50.

Ferro-Manganese.—While domestic ferro is held at $45, foreign is offered in this market at $44.50, and even this price could be shaded on a desirable tonnage.

Muck Bar.—The muck bar market is stronger and neutral bars are held at $28.50 to $28.75, f. o. b. mill, Pittsburg.

Skelp.—There is little buying of skelp, and grooved steel is held at 1.50c to 1.55c and sheared at 1.60c to 1.65c. Grooved iron is held at 1.70c to 1.75c, and sheared at 1.85c to 1.90c.

Rails and Track Material.—Most of the light rail mills throughout this section are shut down and the demand for light sections is extremely limited. With more seasonable weather, however, it is believed the demand will improve and better prices prevail. We make the following quotations: Fifty lb. and over 500 tons, $28; car lots and less than 500 tons, $30; less than car lots, $32; light rails, 16 lb., $26 to $26.50; 20 lb., $24.50 to $25; 25 to 45 lb., $22.50 to $23. Angle bars, 1.25c; spikes, 1.85c to 1.90c.

Plates.—At the meeting of the plate manufacturers held last week a straight advance of $2 a ton was decided upon. This restores the price to that existing before the $4 reduction made last September and is the same as the price which maintained for over three years. It is doubtful now whether any further advance will be made officially. According to the report of the Pressed Steel Car Co., there were orders on its books the first of the year for 8,000 steel cars, which is double the number that this company turned out last year. The Pennsylvania Railroad Co. will place an order for 3,000 steel cars, making a total of over 15,000 cars for this year's delivery. We revise quotations as follows: Tank plates, 1¼ in. thick, 6¼ to 14 in., inclusive, 1.50c f. o. b. mill Pittsburg; over 14 in. up to 100 in., 1.60c. Extras are as follows per lb.: Flange and boiler steel, 10c; marine, A. B. M. A., and ordinary fire box, 20c; still bottom, 30c; locomotive firebox, 50c; plates over 100 in. up to 110 in. in width, not less than 5c per 100 lb. extra; plates 110 in. to 115 in. wide, not less than 10c extra; 115 to 120 in., 15c extra; plates 120 in. to 125 in. wide, not less than 25c extra; plates 125 in. to 130 in., not less than 50c extra; plates 130 in. wide, not less than $1 extra; plates 3-16 in. thick, $2 extra; gauges 7 and 8, $3 extra; No. 9, $5 extra. Five cents extra for less than carloads. Terms net cash in 30 days, and for all points of delivery in the United States except the Pacific Coast.

Structural Material.—Orders for structural material are being received in fair volume, the Riter-Conley Mfg. Co. having

received an order for a building requiring 1,000 tons. The structural material for the Duquesne elevated of the Pennsylvania Railroad has been divided among three steel companies to insure quick shipments. The advance in structural material is $2 a ton and went into effect Thursday, Feb. 16. We revise quotations as follows: Beams and channels up to 15 in., 1.60c; over 15 in., 1.70c; angles, 3 x 2 up to 6 x 6, 1.60c; zees, 1.50c; tees, 1.65c; angles from 3 to 16 in., 1.60c; universal and sheared plates, 6¼ to 14 in., inclusive, 1.50c; over 14 in., 1.60c base.

Bars.—Little new business is being received by local mills in either iron or steel bars, although the specifications on the latter are very heavy. It has been strongly intimated that an advance of $2 a ton will be made shortly in steel bars, one concern already asking this premium for prompt deliveries. We make the following quotations: Bar iron, 1.65c to 1.69¼c Pittsburg; hoops, 1.55c, and bands, 1.40c, both taking bar extras. Bessemer steel bars, 1.40c; open-hearth steel bars, 1.40c; plow and cultivator beams, 1.40c, net; channels, angles, zees and tees, under 3 in., 1.05c. The following differentials are maintained on steel: Less than 2,000 lb. of a size and not less than 1,000 lb., 10 cents advance; less than 1,000 lb. of a size, 30 cents advance.

Sheets.—The trade has been expecting an advance in black sheets, following the recent advances in blue annealed and galvanized, but none has yet been announced. On more than 60-day delivery independent mills are asking an advance of $2 a ton owing to the uncertainty of the steel market. New business is heavy and the outlook is for a tremendous tonnage this year. We quote black sheets, one pass, in carloads, as follows: Black sheets: No. 30, 2.70c; No. 29, 2.60c; No. 28, 2.30c; No. 27, 2.20c; Nos. 25-26, 2.15c; Nos. 23-24, 2.10c; Nos. 18-20, 2.05c; No. 16, 2c; Nos. 12-14, 1.95c; No. 9, 1.90c; No. 8, 1.85c. Galvanized. No. 30, 4.35c; No. 29, 3.85c; No. 28, 3.45c; No. 27, 3.25c; Nos. 25-26, 3.05c; Nos. 23-24, 2.85c; Nos. 18-20, 2.70c; No. 16, 2.55c.

Pipe and Tubes.—Pipe production in the past two months has broken all previous production records, and stocks at all mills, despite this tremendous output, is very low. New business continues to break all records for the first two months of the year and manufacturers are at a loss to know how the demand can be supplied if it shows the proportionate increase of other years when milder weather sets in. Discounts to consumers, carload lots, f. o. b. Pittsburg, plus freight to destination according to Tube Rate Book, are as follows:

MERCHANT PIPE.

	Steel.		Iron.	
	Black.	Galv.	Black.	Galv.
⅛ and ¼ inch	68	52	66	50
⅜ to 6 inches	76	66	74½	64½
⅜ and ½ inch	72	60	70	58
7 to 12 inches	71	58	69½	54
Extra Strong Plain Ends.				
⅛ to ¼ inch	61	49	59	47
⅜ to 4 inches	68	56	66	54
4½ to 8 inches	64	52	62	50
Double extra strong plain ends, ⅜ to 8 inches	57½	46½	55½	44½

MERCHANT BOILER TUBES, CARLOADS, 22 FEET AND UNDER.

	Steel	Iron.
1 to 1½ inches	46	42
1¾ to 2½ inches	58	43
2½ inches	60	48
2¾ to 5 inches	66	55
6 to 13 inches	58	48

Less than carloads 2 points less.

Wire and Wire Nails.—A further advance in wire nails is looked for almost any day. A heavy spring trade is anticipated and shipments from warehouses will be commenced shortly. We make the following quotations: Wire nails, jobbers' carload lots, $1.80; retailers' carload lots, $1.85, and less than carloads, $1.95; painted barb wire, $1.95 for jobbers in carloads; retailers' carloads $2, and less than carloads, $2.10, with 30 cents for galvanizing. Annealed smooth fence wire is held at $1.65, with the usual differentials to retailers for carloads and less than carloads. Quotations are all f. o. b. Pittsburg, 60 days, with 2 percent discount for cash in ten days. Iron cut nails are held at $1.85 Pittsburg, and steel at $1.75.

Merchant Steel.—The shafting association has advanced all kinds of shafting two points. Demand is heavy and owing to the increase in the price of steel this advance is justified. We revise quotations as follows: Cold rolled and ground shafting, 50 percent off in carload lots, and 45 off in less than car lots, delivered in base territory; tire steel, 1.60c to 1.65c; open-hearth spring steel, 2c to 2.10c; sleigh shoe, flat, 1.55c to 1.60c; smooth finished machinery steel, 1.60c; toe calk, 1.95c to 2c.

Old Material.—The market continues very quiet and heavy melting stock continues to be offered down to $16 and $16.25. There is no improvement in cast scrap as none of the foundries are buying. We make the following quotations, gross tons: Heavy melting stock, $16.25 to $16.35; low phosphorus, $19.50 to $20.50; rerolling rails, $16 to $16.50; sheet scrap, $14 to $14.25; No. 1 wrought, $19 to $19.50; cast iron borings, $11 to $11.25.

Coke.—Shipments of coke from the Connellsville region, especially to the East, are improving, and the large stocks amounting to over 200,000 tons in the yards of shippers are being fast depleted. Prices are firm and furnace coke for prompt delivery is held at $2.50 to $2.60 and foundry at $2.75 to $3.25. Production for the week ending February 11 in the upper region amounted to 255,923 tons, while the lower region produced 74,634 tons.

CHICAGO.

OFFICE OF *The Iron Trade Review*,
1164 MONADNOCK BLOCK, Feb. 21.

The most important development of the iron and steel market in the week under review is the advance of $2 a ton in plates and structurals which went into effect Thursday, the 16th. The states on the Pacific Coast do not share in this advance, material for shipment into that territory remaining on the old basis of 1.40c Pittsburg. With this exception, however, the new quotations cover all sections of the country. The new prices did not come wholly as a surprise to the trade, an advance having been expected for several weeks in view of the active demand for both products. Steel bars, which continue on the basis of 1.40c Pittsburg, are the next material in which an advance is looked for, but whether the advance will be announced before or after the agricultural trade has bought is problematical. In past years, these interests have contracted for their annual requirements in the spring, and advances have usually been put into effect after most of them had covered. Since the first of January, the specifications for steel bars have been very heavy, and of late a brisk supplementary demand has been felt. The eagerness of consumers to get quick deliveries is suggestive of low stock piles and that most of the material is wanted for immediate consumption. The shortage of Bessemer and open hearth billets and bars, and the willingness of consumers to pay premiums ranging from $2 to $4 a ton for same, together with the fact that kindred finished rolled products are now on a higher basis are other reasons which will force an advance in steel bars before long. Increased activity is noted in the sales of pig iron, which statement in brief sums up the situation as it is today. The weakness that was felt two weeks ago appears to have entirely vanished and the market is now more buoyant. The sales of standard rails continue of excellent proportions, the leading Western interest having booked over 90,000 tons since the first of February. Light rails are quiet, but prices remain firm. Blue annealed and galvanized sheets are selling freely at the higher prices which went into force two weeks ago. Pipes and tubes are also enjoying a good movement, specifications from jobbers and consumers having increased since the advent of warm weather. Some weakness has developed in bar iron, and reports are current that 1.65c Chicago has been shaded on recent sales. The scrap market remains quiet, and though several railroad lists are out, no eagerness is displayed by dealers in bidding on same. Prices are

shaky. No change is apparent in wire products, the demand for which continues without diminution.

Pig Iron.—The buying of pig iron in Chicago and contiguous territory while probably more general than it was a week ago, continues of light volume. The market, however, is more buoyant than it was on the date of our last report, and the slump in prices that seemed so imminent two weeks ago has been averted. Today both Southern and Northern irons are strong on the basis of $17.15 and $17.50 Chicago respectively for No. 2 foundry. There are some Southern interests asking 25 cents a ton above the former price for third quarter deliveries, but it is needless to add that these producers are taking on little new tonnage for that period. The attitude of western buyers, despite the better inquiry that has been felt in the week under review and the improved tone of the market that exists, continues at variance with the views of sellers as to present or prospective prices. This attitude is not an inconsistent one from their standpoint, for the jobbing foundry trade in this section of the country has been notoriously quiet for several months. It has not picked up since the first of the year to the extent that was expected, and although it may improve with the advent of warmer weather, melters are not prone to be too sanguine in this respect when discussing the placing of an order for iron. Most of them have good stocks on hand, having taken all that was shipped against the contracts placed last fall, and this fullness may in part account for the lack of interest shown in the market today. The manufacturing founders are very busy, however, and it is these interests that are doing most of the buying. Orders closed in the week under review range from lots of 2,000 tons to carloads, the smaller quantities predominating. Prices are unchanged, and we quote as follows:

Lake Superior Charcoal	$18 50 to 19 00
Northern Foundry No. 1	18 00
Northern Foundry No. 2	17 50
Northern Foundry No. 3	17 00
Northern Scotch Foundry	18 50
Ohio Strong Softeners No. 1	19 30 to 19 80
Ohio Strong Softeners No. 2	18 30 to 18 80
Southern Foundry No. 1	17 65 to 18 15
Southern Foundry No. 2	17 15 to 17 65
Southern Foundry No. 3	16 65 to 17 15
Southern Foundry No. 4	16 40 to 16 90
Southern No. 1 Soft	17 65 to 18 15
Southern No. 2 Soft	17 15 to 17 90
Southern Gray Forge	16 40
Southern Mottled	16 40
Southern Silveries (4% to 6% Silicon)	18 65 to 19 15
Jackson Co. Silveries (6% to 8% Silicon)	21 30 to 22 30
Jackson Co. Silveries (8% to 10% Silicon)	23 30 to 24 30
Alabama and Georgia Car Wheel	21 15
Malleable Bessemer	17 50
Basic Iron	17 65 to 18 15

Billets.—Small lots of rerolling billets have been in demand in this market, and recent sales have brought premiums of $4 a ton. Forging billets are also scarce and in good demand, premiums being cheerfully paid on quick deliveries. We quote forging billets, 4 x 4 and larger, up to but not including 10 x 10, up to .25 carbon, $28; up to and including .60 carbon, $1 extra. Rerolling billets, Bessemer or open hearth, 4 x 4 and large, $27 and upwards; billets, 3⅞-in. and smaller and sheet and tin bars, $29 and upwards, according to the tonnage and delivery. Wire rods are scarce and are quoted at $33 Pittsburg.

Bars.—Specifications for steel bars show no diminution, all consumers taking the full quotas against their contracts. The volume of new business is also daily increasing, many of the trade contracting for their requirements to July 1 next. Iron bars are dull. Prices have weakened perceptibly and some reports say that 1.65c Chicago has been shaded. The leading Western interest, however, avers that it is maintaining this schedule strongly. We quote carload lots, mill shipments, Chicago delivery, as follows: Bessemer and open-hearth bars and bands, 1.56½c base, half extras; soft steel angles, less than 3 x 3, 1.76½c; hard steel angles rolled from old rails, 1.60c to 1.65c; hoops, 1.71½c base, full extras. Store quotations are firm, and we quote on lots from warehouse stocks, as follows: Bar iron, 1.90c to 2c base, full extras; soft steel bars and bands, 1.75c to 1.85c base, full extras; soft steel angles, channels and tees, 1.85c to 1.95c; hoops, 2c to 2.10c base, full extras.

Sheets.—The market has amply sustained the advances announced last week in blue annealed and galvanized sheets. Demand is of good proportions, and some interests are temporarily out of the market. Store trade is also active and the outlook is hopeful. Prices are without change, and we quote carload lots, mill shipments, Chicago delivery, as follows: Blue annealed sheets, Nos. 9 to 10, 1.81½c to 1.86½c; Nos. 11 and 12, 1.86½c to 1.91½c; Nos. 13 and 14, 1.91c to 1.96½c; Nos. 15 and 16, 2.01½c to 2.06½c. On box annealed, one pass, cold rolled, we quote Nos. 18 and 20, 2.21½c to 2.26½c; Nos. 22 and 24, 2.26½c to 2.31½c; Nos. 25 and 26, 2.31½c to 2.36½c; No. 27, 2.36½c to 2.41½c; No. 28, 2.46½c to 2.51½c; No. 29, 2.56½c to 2.61½c; No. 30, 2.66½c to 2.71½c. We quote on lots from warehouse stocks as follows: No. 10, 2c to 2.05c; No. 12, 2.05c to 2.10c; No. 14, 2.10c to 2.15c; No. 16, 2.20c to 2.25c; Nos. 18 and 20, 2.40c to 2.45c; Nos. 22 and 24, 2.45c to 2.50c; No. 26, 2.60c to 2.65c; No. 27, 2.70c to 2.75c; No. 28, 2.80c to 2.85c; No. 29, 2.90c to 2.95c. Galvanized sheets, mill shipments, Chicago delivery, are quoted as follows: Nos. 12-14, 2.56½c; No. 16, 2.71½c; Nos. 18-21, 2.86½c; Nos. 22-24, 3.01½c; No. 26, 3.21½c; No. 27, 3.41½c; No. 28, 3.61½c; No. 29, 3.86½c. Jobbers' prices on lots from store have also been revised, and are now as follows: Nos. 10 to 16 inclusive, 3.10c; Nos. 18-20, 3.11c; Nos. 22-24, 3.25c; No. 26, 3.48c to 3.50c; No. 27, 3.70c; No. 28, 3.95c; No. 29, 4.30c to 4.40c; No. 30, 4.85c.

Structural Steel.—On Thursday, the 16th, an advance of $2 a ton on all structural shapes went into effect, both mill and store prices being advanced. Specifications for material continue good, and during the week several inquiries for round lots have appeared in the market. We have revised our prices, and quote carload lots, mill shipments, Chicago delivery, as follows: Beams and channels, 3 to 15 in. inclusive, 1.76½c; angles, 3 to 6 in., ¼ in. and heavier, 1.76½c; angles larger than 6 in. on one or both legs, 1.86½c; beams larger than 15 in., 1.86½c; zees, 3 in. and over, 1.76½c; tees, 3 in. and over, 1.86½c; with the usual extras for cutting to exact lengths, punching, coping, bending or other shop work. We quote the new prices from store as follows: 2c to 2.10c for angles, beams and channels, base sizes, with 2.10c to 2.20c for 18, 20 and 24-in. beams; tees and zees, 2.05c to 2.15c. These prices are for either random lengths or cut to specifications.

Plates.—The advance of $2 a ton in plates has not diminished either the inquiry for new tonnage or the specifications against old orders. Both have actively increased in the last week, and mills are getting behind in their shipments. This condition is particularly true of the leading Western producer, which has for some weeks been booking a considerably larger tonnage each day than its output. We have revised our prices, and quote carload lots, mill shipments, Chicago delivery, as follows: Tank steel, ¼ in. and heavier, 6¼c in. to 14 in. wide, rectangular plates only, 1.66½; over 14 in. to 100 in., 1.76½c base; flange steel, 1.86½c base; marine steel, 1.96½c base, all full extras. Plates, 3-16 in. thick, $2 extra; gauges, 7 to 8, $3 extra; No. 9, $5 extra. Less than carload lots, $5 extra. Store prices have also been advanced. Revised quotations are as follows: Tank steel, ¼ in. and heavier, up to and including 72 in. wide, 2c; over 72 in. wide up to 100 in., 1.20c extra; over 100 in. wide, usual mill extras; 3-16 in. up to but not including 72 in. wide, 2.10c; 3-16 in., 72 in. wide, 2.35c; flange steel, 25c extra; heads, 25c extra.

Rails and Track Supplies.—The leading Western producer reports there is no diminution in the demand for standard rails. Since the first of February it has booked orders approximating 90,000 tons, and has inquiries pending that will bring this amount to considerably over 100,000 tons before

the month is out. In the week under review, about 50,000 tons were placed. Track supplies are also in excellent demand, the entire output of western producers going into immediate consumption. The demand for light rails has fallen off considerably, although prices are unchanged. We quote heavy sections in 500-ton lots and over, f. o. b. bill, $28; less than 500 tons to carload lots, $30; less than carload lots, $32. Light rails are as follows: 12-lb. sections, $27; 16-lb., $26; 20 and 25-lb., $25; 30, 35, 40 and 45-lb. sections, $24, all f. o. b. Milwaukee mill. Track supplies, f. o. b. Joliet mill: Angle bars, 1.40c to 1.50c; spikes, first quality, 1.70c to 1.75c; track bolts, 3¼ x ¾, with square nuts, 2.40c to 2.50c per lb., with hexagon nuts, 2.55c to 2.65c.

Merchant Steel.—There is little of news interest to report regarding the situation in this product. The demand continues of the same active proportions, consumers pressing producers constantly for quicker deliveries. The leading interest is still out of the market, having long ago sold its entire output for several months ahead. Prices are without change, and we quote carload lots, mill shipments, Chicago delivery, as follows: Spring steel, 2c; sleigh shoe, flat sizes, 1.61½c; concave and convex, 1.76½c; cutter shoe, 2.25c; smooth finished machinery steel, 1.81½c; smooth finished tire, 1.76½c; plow steel, 2.20c and upwards, according to quality; toe calk steel, 2.11½c. Crucible tool steel, 6½c to 8c; special grades of tool steel, 13c and upwards. Cold rolled shafting is quoted as 52 percent from list on carload lots, and 47 percent discount on less than carload lots.

Merchant Pipe.—Specifications and new business are both of good volume and prices are without change. This is about all that can be said regarding this product. We quote carload lots, mill shipments, random lengths, f. o. b. Chicago, as follows:

MERCHANT PIPE.

	Steel.		Iron.	
	Black. Percent.	Galv. Percent.	Black. Percent.	Galv. Percent.
⅛ to ¼ inches	66.35	50.35	64.35	48.35
⅜ to ½ inches	70.35	58.35	68.35	56.35
¾ to 6 inches	74.35	64.35	72.85	62.85
7 to 12 inches	69.35	54.35	67.85	52.35
EXTRA STRONG PIPE.				
⅛ to ⅜ inches	59.35	47.35	57.35	45.35
½ to 4 inches	66.35	54.35	64.35	52.35
4½ to 8 inches	62.35	50.35	60.35	48.35
DOUBLE EXTRA STRONG PIPE.				
½ to 8 inches	55.35	44.35	53.35	42.35

Boiler Tubes.—Business in the week under review has been of good volume, and inquiries pending are of such a nature as to indicate a continuance of the better conditions prevailing. Prices are without change, and we quote carload lots, mill shipments, as follows:

BOILER TUBES.

	Steel.	Iron.	Seamless.
1 to 1½ inches	42.35	39.35	52.35
1¾ to 2¼ inches	54.35	29.35	40.35
2½ inches	56.35	44.35	43.35
2¾ to 5 inches	62.35	51.35	Up to 4 inches. 50.35
6 to 13 inches	54.35	39.35	.....

Less than carload lots from store, as follows:

	Steel.	Iron.	Seamless Steel.
1 to 1½ inches, inclusive	40½	37½	40
1¾ to 2¼ inches, inclusive	50½	35	37½
2½ inches, inclusive	53	37½	40
2¾ to 5 inches, inclusive	60¼	47½	47½
6 inches and larger	50½	35	

Cast Iron Pipe.—Little of importance has developed in the week under review. The western trade has not yet opened up owing to the prevalence of cold weather, and no change is looked for until the latter part of March. Prices are firm. We quote carload lots, Chicago delivery as follows: 4-in. water pipe, $28.50; 6-in. and larger, $27.50; gas pipe, $1 a ton higher.

Wire Products.—Demand continues of active proportions, the general situation being unchanged. Prices are firm. We quote carload lots to jobbers, mill shipments, Chicago delivery, as follows: Wire nails, $1.95; painted barb wire, 2.10; galvanized barb wire, $2.40; smooth annealed wire, $1.80; smooth galvanized wire, $2.10; polished staples, $2.05; galvanized staples, $2.35. Less than carload lots to jobbers are 5 cents higher than above prices. The retail trade is quoted 5 cents extra over the foregoing on carload lots, and 10 cents extra on less than carload lots. Bale ties are unchanged at 82½ and 5 percent to 85 percent discount f. o. b. Waukegan, Ill., on straight carload lots. Poultry netting, 85 and 5 percent discount from list f. o. b. Joliet and DeKalb, with actual freight allowed not exceeding 30 cents per 100 lb.

Foundry Coke.—Demand for coke is of normal proportions, and there now appears to be plenty of fuel to satisfy local needs. Prices are without material change, being firm on the basis of $3 at Connellsville for 72-hour foundry or $5.65 Chicago in car lots. Less popular brands of Virginia and West Virginia cokes are selling at from $2.50 to $2.75 at the ovens. Wise County, Virginia, coke at $3 at the ovens, makes the going price here $5.25.

Old Material.—There has not been enough demand in the past week to substantially change the local situation. Prices continue weak and shaky, old iron rails, dealers' forge, cast and mixed borings all being quotably lower than a week ago. Three railroad lists have been on the market for several days, but at the time of writing had not been bought up by dealers. This lack of interest in new tonnage reflects very truthfully the condition of the local market. The lists mentioned include one from the C. B. & Q., for 2,500 tons; Rock Island, 1,500, and one from the C. & E. L. for 500 tons. We have revised our prices, and quote as follows: Gross tons:

Old steel rails (4 feet and over)	$15 00 to 15 50
Old steel rails (less than 4 feet)	16 00 to 16 50
Old iron rails	19 50 to 20 00
Relaying rails, subject to inspection	22 00 to 22 50
Relaying rails, without inspection	20 00 to 20 50
Old wheels	16 50 to 17 00
Heavy melting steel	14 50 to 15 00
Mixed country steel	9 50 to 10 50
Low phosphorus scrap (.05 and under)	14 00 to 14 50

The following quotations are for net tons:

No. 1 R. R. wrought	17 00 to 17 50
No. 2 R. R. wrought	16 00 to 16 50
Shafting	17 00 to 17 50
Dealers' forge, No. 1	12 00 to 12 50
Wrought pipe and flues	11 00 to 11 50
No. 1 cast, 150 lbs. and less	13 50 to 14 00
No. 1 mill	11 00 to 11 50
No. 1 Busheling	11 50 to 12 00
No. 2 Busheling	10 50 to 11 00
Country sheet	8 00 to 8 50
No. 1 boilers, cut	11 00 to 11 50
Boiler punchings	13 00 to 13 50
Iron car axles	21 00 to 21 50
Steel car axles	16 50 to 17 00
Iron axle turnings	11 50 to 12 00
Steel axle turnings	11 00 to 11 50
Cast borings	8 25 to 8 75
Mixed borings, etc	8 25 to 8 75
Machine shop turnings	11 00 to 11 50
Railroad malleable	13 50 to 14 00
Agricultural malleable	12 00 to 12 00
Stove plate and light cast scrap	11 00 to 11 50
Old iron splice bars	18 00 to 18 50

CLEVELAND.

OFFICE OF *The Iron Trade Review*, BROWNING BUILDING, Feb. 22.

Iron Ore.—Sales are still being made, but the higher grades of ore are very scarce, as there is little but silicious ore to be had. Quotations are now as follows: Old range Bessemer, $4; Mesabi Bessemer, $3.50; old range non-Bessemer, $3.35; Mesabi non-Bessemer, $3.10 to $3.25.

Engineers have demanded an advance of $25 per month for chief engineers on boats of 5,500 tons and over, $15 for first assistants, and $5 for second assistants. The presentation of this demand will result in a conference of representatives of the vessel owners and the union and a compromise will probably be agreed upon. So far, the prospect of adjusting all wage schedules is favorable. The executive committee of the Lake Carriers' Association today began consideration of labor questions.

Pig Iron.—The most important event of the week was the sale of 25,000 tons of malleable by a Cleveland firm to Eastern interests. With this exception, no business of consequence has

been transacted. There are some reports of concessions below $16 at the Valley furnace for No. 2 and the local market is not so strong, iron having been sold in this city at $16.25 delivered. In spite of the high price, Southern iron is still being sold here in limited quantities at $13.50 to $13.75 Birmingham for No. 2. We quote as follows, Cleveland delivery:

Bessemer	$16 10 to 16 35
No. 1 Foundry	16 75 to 17 00
No. 2 Foundry	16 25 to 16 50
No. 3 Foundry	15 50 to 15 75
No. 2 Southern	17 35 to 17 60
Gray Forge	15 75 to 16 00
Gray Forge, Southern	15 85 to 16 35
Lake Superior charcoal	18 00 to 18 50

Finished Material.—Mills are falling further behind in deliveries and are having much difficulty in satisfying customers. In spite of the strong demand, there is one feature of present conditions which is not entirely satisfactory; that is, the buyers are, as a rule, the large companies, especially those which manufacture for the railroads, while many small companies are seldom heard from. This condition exists even in the jobbing houses, where orders are being received from the largest locomotive manufacturers in the country who have not been able to obtain prompt delivery from mills. Steel bars are still quoted at 1.49½c Cleveland, but an advance is probable. Bar iron is in moderate demand at 1.65c at the mills. The recent advance in galvanized and blue annealed sheets has not appreciably affected the demand. Th prices of the principal producers through jobbers are as follows: Cleveland delivery, the freight from Pittsburg being 9½ cents: Mill sales of black sheets in carload lots, No. 10, 1.84½c; Nos. 11-12, 1.89½c; No. 14, 1.94½c; No. 16, 2.04½c; No. 27, 2.39¼c; No. 28, 2.40¼c. Galvanized, mill sales, No. 14, 2.64½c; No. 16, 2.74½c; Nos. 18-20, 2.89½c; Nos. 22-24, 3.04½c; Nos. 25-26, 3.24½c; No. 27, 3.44½c; No. 28, 3.64½c. Out of stock, black sheets, ¼ in., 1.85c; 3-16 in., 1.95c. Blue annealed, No. 10, 2.05c; No. 12, 2.10c; No. 14, 2.15c; No. 16, 2.25c. One pass cold rolled: Nos. 18-20, 2.45c; Nos. 22-24, 2.50c; No. 26, 2.55c; No. 27, 2.60c; No. 28, 2.70c; No. 30, 3.10c. Galvanized out of stock, No. 16, 2.95c; Nos. 18-20, 3.05c; Nos. 22-24, 3.50c; No. 26, 3.40c; No 27, 3.60c; No. 28, 3.80c; No. 30, 4.60c.

Old Material.—The market is extremely dull and, while prices are tending downward, dealers are slow to make concessions and sales are few. We quote as follows, gross tons, Cleveland:

Old iron rails	$23 00 to 23 50
Old steel rails (over 6 feet)	16 00 to 16 50
Old steel rails (under 6 feet)	16 50 to 17 00
Old car wheels	15 50 to 16 00
Steel boiler plate	13 00 to 13 50
Steel axles	16 50 to 17 00
Malleable iron (railroad)	15 00 to 15 50
Malleable iron (agricultural)	14 00 to 14 50
Heavy steel	16 00 to 16 50

We quote as follows, net tons:

No. 1 R. R. wrought	16 50 to 17 00
No. 1 busheling	14 00 to 14 50
No. 1 machine cast	14 50 to 15 00
Iron axles	19 00 to 20 00
Axle turnings	10 50 to 11 00
Wrought turnings (free from cast)	10 00 to 10 50
Grate bars	10 00 to 10 50
Pipes and flues	13 00 to 14 00
Tank iron	10 50 to 11 00
Hoop and band iron	9 00 to 10 00
Sheet iron	7 00 to 8 00
Wrought drillings	12 00 to 12 50
Stove plate	10 50 to 11 00
Cast borings	8 00 to 8 50

CINCINNATI.

Feb. 21.

Coke.—The market is easy and quotations are slightly lower than a week ago. Furnace coke is now quotable at $2.40 to $2.50 f. o. b. ovens. Foundry coke ranges from $2.75 to $3.00 per ton f. o. b. ovens, with only a moderate inquiry. The recent wintry conditions have interfered seriously with transportation and it is difficult to get shipments forward.

Pig Iron.—The buying of the week has not been so large as in the previous week, still several round lots are reported. A large plumbing supply manufacturer took about 10,000 tons for Pittsburg delivery and about 6,000 tons for Louisville delivery. About one-half of the latter purchase is for delivery in the third quarter of the year. The leading cast iron pipe interest bought several lots approximating 10,000 tons in the aggregate. A Virginia pipe manufacturer took 8,500 tons. Three important inquiries have come out, one from a Michigan stove manufacturer for 3,000 tons for second quarter delivery, one from a car building concern for 2,250 tons for delivery at Detroit, and 1,250 tons for delivery at a Missouri point. Another large manufacturer asks for prices on 3,250 tons for delivery over the last half of the year. The rest of the buying and inquiry has been made up of small lots ranging from 50 to 100 tons and so far as the general run of foundry iron consumers is concerned they show but little interest in the market. Prices are generally well maintained, but cannot be called firm. There are intimations that the established price of $13.50 for No. 2 at Birmingham has been shaded, still the bulk of the business going is at this figure, so that a steady tone prevails. Quotations for No. 4 foundry and gray forge are slightly reduced. Some lots of re-sale iron bought at low prices for investment are now coming out and are being disposed of slightly under current prices, but this is not being done to an extent to disturb values at the furnaces. Summarizing trade sentiment, it may be said that there is a more confident feeling in the maintenance of present prices that there was two weeks ago. While this is true, the comment is frequently made that heavy buying seems to come from only a few of the larger concerns and that the visits of traveling men among the general consuming interests produce but little in the way or orders. There seems to be increasing willingness on the part of southern furnaces to accept third quarter business at present prices. In Northern irons the market is quiet and the minimum quotation of $16 for No. 2 foundry at furnace is still maintained. We quote f. o. b. Cincinnati as follows:

Southern Foundry No. 1	$16 75 to 17 00
Southern Foundry No. 2	16 25 to 16 50
Southern Foundry No. 3	15 75 to 16 00
Southern Foundry No. 4	15 25 to 15 50
Southern Foundry No. 1, soft	16 75 to 17 00
Southern Foundry No. 2, soft	16 25 to 16 50
Gray Forge	15 00 to 15 25
Northern Foundry No. 1	17 65 to 18 15
Northern Foundry No. 2	17 15 to 17 65
Northern Foundry No. 3	16 65 to 17 15
Southern Charcoal	19 50 to 19 75

Finished Material.—It is believed that severe winter conditions have interfered somewhat with the general demand, still a strong tone prevails and prices are well maintained. Inquiries have been steadily increasing in the recent past and the volume of orders is reported as quite satisfactory. An advance of $2 per ton in tank plates and structural shapes is reported. Bar iron is quoted at 1.75c; steel bars at 1.53c, half extras, with dealers quoting 1.85c for iron and steel out of store. Galvanized sheets at 75 and 7½ percent off. We quote black sheets, No. 27, at 2.40c in car lots of 500 bundles. Black sheets out of store are selling as follows: No. 28, 2.70c; No. 27, 2.60c; No. 16, 2.20c; No. 14, 2.10c; No. 12, 2.05c; No. 10, 2c. Tank plates are firm and sell out of stores at 2c for ¼-in and 2.10c for 3-16 No. 8 and No. 10. Beams and channels are quoted at 2c from stock, and angles at 2c to 2.05c for base sizes.

In merchant pipe there is but little change to note and there is a fair volume of business with prices about steady. We quote:

MERCHANT PIPE.

(Basing Discounts.)

	Steel Pipe. Black. Percent.	Steel Pipe. Galv. Percent.	Guaranteed. Wrought Iron Pipe. Black. Percent.	Guaranteed. Wrought Iron Pipe. Galv. Percent.
⅛ and ¼ inches	66.35	50.35	64.35	48.35
⅜ and ½ inches	70.35	58.35	68.35	56.35
¾ to 6 inches	74.35	64.35	77.85	62.85
7 to 12 inches	69.35	54.35	67.85	52.35

Old Material.—The demend is light and the market is quiet without quotable change. We quote:

Old No. 1 railroad wrought, net tons	$16 50 to 17 00
Cast machine and foundry, net tons	13 50 to 14 00
Old iron rails, gross tons	20 00 to 21 00
Old steel rails, gross tons	15 00 to 15 50
Old short lengths, gross tons	14 00 to 14 50
Old iron axles, net tons	19 00 to 20 00
Stove plate, net tons	9 50 to 10 00
Wrought turnings, net tons	12 50 to 13 00
Cast borings, net tons	9 00 to 9 50

NEW YORK.

OFFICE OF *The Iron Trade Review*,
ROOM 1315, No. 150 NASSAU ST., Feb. 21.

The meetings of the beam and plate pools held at Jersey City during the past week concluded with prices in both products being advanced $2 per ton. It is said that the Eastern Bar Iron Association met during the week also, but decided to make no change in prices for the time being. The Steel Bar Association is scheduled to meet in Pittsburg this week, when it is almost certain that prices will be advanced several dollars per ton.

Pig Iron.—The improvement which set in in the local pig iron market during the past few weeks, continued for the week under review. Sales were very liberal, and were equally divided between foundry and steel making irons, with large consumers manifesting a greater willingness to contract than for a month past. Inquiries for round lots, especially in foundry grades, show marked animation. The General Electric Co. has inquiries out for 4,600 tons of foundry pig on special analysis, and for 1,000 tons of Bessemer, mostly for delivery the third quarter. For small lots of foundry iron the request has been much better also, with deliveries running from prompt shipment to the third quarter. The International Steam Pump Co. purchased 5,200 tons of foundry on special analysis during the week, divided about equally between Buffalo, Philadelphia and Cleveland interests. Sales of basic included one lot of 7,500 tons to the Eastern Steel Co. and another for 5,000 tons, details not given. Prices show no change from the week previous. At Eastern Pennsylvania furnaces sales of No. 2 foundry have alternated between $16.50 and $16.75, large lots commanding the former price, and small ones the latter. In Southern grades the bulk of No. 2 foundry at Birmingham has sold at $13.50 but occasional small orders brought $13.75. The general situation bears a brighter aspect, and opinion is that only severe weather can prevent continued activity, with higher prices. New York quotations at tidewater follow: Northern No. 1 foundry, $17.50 to $18; No. 2 foundry, $17.25 to $17.50; No. 2 plain, $16.75 to $17; Southern No. 1 foundry, $17.50 to $17.75; No. 2 foundry, $17 to $17.25; No. 3 foundry, $16.50 to $16.75; No. 4 foundry, $16 to 16.25. Pig iron warrants are as follows:

	Bid.	Asked.
February	$16 10	$16 40
March	16 10	16 40
April	16 10	16 40
May	16 10	16 35
June	16 10	16 40
July	16 15	16 50

Rails.—The market for the week has been quiet, with some excellent tonnage likely to be closed any day. The order of the Grand Trunk for 500 tons, noted last week, has been increased to 3,500 tons.

Finished Iron and Steel.—So far as orders for round lots are concerned, the past week in structural shapes has not been productive of anything. There is an excellent tonnage pending, with the chances good for its developing into orders at any time. The business in small lots for the week made a fair tonnage. In plates there was a fair amount of new business, with the outlook better than it has been. For bars and sheets there has been a fair demand, with conditions improving. New York prices at tidewater follow: Angles, 3 to 6 in. x ¼ in. and heavier, 1.74½c; beams, 3 to 15 in., 1.74½c; channels, 3 to 15 in., 1.74½c; beams, 18, 20 and 24 in., 1.84½c; tees, 3 x ¼ in. and heavier, 1.79½c; plates, carloads, tank, 1.74½c; flange, 1.84½c; marine and ordinary fire box, 1.94½c; refined iron bars, 1.64½c; soft steel bars, 1.54½c to 1.60c; sheets, in carload lots, New York, No. 28, black, 2.50c to 2.55c; galvanized, 3.55c to 3.60c.

Old Material.—Light sales have been the rule during the past week, with No. 1 machinery cast, stove plate, and cast borings the recipients of more attention than for some time past. Other kinds of material have been fairly active. Prices all along the line have been firm, with quotations showing the usual irregularity where the tendency to buy is more pronounced than that to sell. Approximate prices here f. o. b. cars follow:

Old iron rails	$20 00 to 22 00
Old steel rails, long lengths	16 00 to 17 00
Old steel rails, short pieces	15 50 to 16 50
Relaying rails	21 00 to 22 00
Old car wheels	16 00 to 16 50
Old iron car axles	21 00 to 21 50
Old steel car axles	17 00 to 18 00
Heavy melting steel scrap	16 00 to 17 00
No. 1 railroad wrought scrap	19 00 to 21 00
Iron track scrap	17 00 to 18 50
Wrought pipe	13 00 to 14 00
Ordinary light iron	12 00 to 13 00
Cast borings	10 00 to 10 50
Wrought turnings	12 50 to 13 50
No. 1 machinery cast	16 00 to 16 50
Stove plate	13 50 to 14 00

The Metal Market.

NEW YORK.

OFFICE OF *The Iron Trade Review*,
ROOM 1315, No. 150 NASSAU ST., Feb. 21.

Pig Tin.—Heavy arrivals at Atlantic ports, as well as much heavier ones en route, coupled with an extremely limited demand from consumers, have all combined to effect a considerable falling off in prices during the past week, spot having been particularly vulnerable. Opinions as to the outlook all agree upon a lower level of prices for the near future. In London the market has been heavy also, and prices sold off about £1½. Today's closing follow: Spot, 28.75 to 29c; February, 28.75 to 28.87½c; March, 28.60 to 28.75c; April, 28.45 to 28.55c. London's closings today follow: Spot, £130 15s; futures, £130 5s. Arrivale at Atlantic ports for the month to date aggregate 3,490 tons, with 4,910 tons afloat.

Copper.—The market for the past week was without interest. The trade situation was very quiet. Prices are unchanged. In London the market has been fairly active, with prices a little higher now than a week ago. Closing prices today follow: Lake, 15¼ to 15⅜c; electrolytic, 15⅛ to 15¼c; casting, 14⅞ to 15c. London's closings today follow: Spot, £68 6s 3d; futures, £68 13s. Exports for the month to date aggregate 6,863 tons, a material falling off from last month.

Lead.—Is quiet and unchanged at 4.55 to 4.60c for spot. St. Louis remains at 4.35c. London is slightly higher at £12 10s.

Spelter.—There has been little doing, and spot still commands 6.10 to 6.20c. St. Louis is a shade higher at 6c. London declined to £24 10s.

Antimony.—All grades were weaker during the past week. Cookson's is now selling at 8 to 8.25c; Hallett's, at 7.87½ to 8.87½c, and other brands at 7 to 7.75c.

Quicksilver.—We quote $40 per flask of 75 lb. lots of 100 flasks. London is £7 12s 6d.

CHICAGO.

OFFICE OF *The Iron Trade Review*,
1164 MONADNOCK BLOCK, Feb. 21.

The demand for metals in this market continues of light proportions. Prices of spelter are firm, the market showing no evidence of any recession from the high values established. The heavy demand for galvanized sheets, etc., has caused a corresponding scarcity of spelter, which accounts for the firmness of the market. Pig tin is without change, and there appears to be plenty of metal on the market. Copper is shaky, though quotations this week are without appreciable change. Our prices are as follows: Lake copper in carloads, 15⅜c; less than carloads, 15⅝c. Casting copper, in carloads, 15⅛c;

less than carload lots, 15⅜c. Pig tin, carload lots, 30⅛c; less than carload lots, 30½c. Spelter, 6¼c to 6½c for carload lots, and 6½c to 6¼c for smaller lots. Sheet zinc is unchanged at 7¼c for carload lots of 600-lb. casks, and 7½c for less than carload lots. Pig lead, 4.45c for 50-ton lots; 4½c for carload lots, and 5c to 5¼c for less than carload lots. Antimony is 9½c for Cookson's and 9c for Hallett's in small quantities. Nickel is 45c to 60c, according to amount and deliveries.

Old metals are in better demand than a week ago and prices of same are stronger. Dealer's quotations are approximately as follows: Copper wire, 13¼c; heavy copper, 12¾c. Light copper, 11¾c. Red brass, 11¾c; red brass borings, 10⅛c. Yellow brass, 8¾c; yellow brass borings, 7½c. Pipe lead, 4c. Tea lead, 3.60c. Zinc, 4¼c.

Midvale Co. Gets Part of Tonnage.

Secretary Morton has reconsidered his decision to reject the recent bids for armor plate made by the Midvale Steel Co. of Pennsylvania and it was announced Feb. 21 that he will award to that company, which was the lowest bidder, a contract for 1,000 tons of the 8,000 tons wanted. A vigorous protest was lodged with the president Feb. 20 against the recent award by the navy department of a contract for armor plate to the Bethlehem and Carnegie companies. The protest was made by the officers of the Midvale Steel Co., Charles J. Harrah, president; J. F. Sullivan, vice president; and Axel Petre, chief engineer, who were introduced to the president by Representative Morrell of Pennsylvania. They declared their ability to fill the order of the government as promptly and as satisfactorily as the Bethlehem and Carnegie works. They urged that the fact that their bid for the armor was much lower than that of the other companies entitled them to consideration, which they did not receive at the hands of the navy department. They said they felt an injustice had been done them by awarding the contract to a much higher bidder. The president said he would take the matter under consideration. Later Representative Morrell and the officers of the Midvale works had a conference with Secretary Morton.

Chicago Pneumatic Tool Co. Meeting.

The annual meeting of the stockholders of the Chicago Pneumatic Tool Co. was held in Jersey City Feb. 20. Charles M. Schwab, F. M. Prince and J. W. Budworth, the directors whose terms expired, were all re-elected. President J. W. Duntley presented the following statement, giving information regarding the company's financial condition additional to that made public some weeks ago:

"Your attention is called to the showing of quick assets, amounting to $1,263,372.73, against which are current liabilities of $156,943.49, which includes accrued interests on bonds. The excess of current assets, amounting to $1,108,602.39, shows an increase of over $450,000 since your company was organized, Jan. 1, 1902, notwithstanding liberal appropriations for improvement work, and on account of the Fraserburgh (Scotland) plant.

"In the surplus account $195,324.45 was added for the year 1904. The surplus added for 1903 was $113,706.37. With the improved trade conditions during the past quarter, the demand for our tools and equipment has increased until our factories are now running to their full capacity in order to supply the demand."

Through their agents, the Miller Supply Co., of Huntington, W. Va., the A. S. Cameron Steam Pump Works are in receipt of an order for a 5 x 12 power driven pump, to be used for the water supply of the Crescent Glass Co., of Weston, W. Va. The pump is composition fitted and will have a capacity of 150,000 gallons per day at ordinary speed.

Proposed Southern Consolidation.

(Special Telegram.)

NEW YORK, Feb. 22.—Important conferences are being held in this city this week for the purpose of effecting a consolidation of the leading Southern iron interests. The conferees, with the companies they represented, are as follows: J. C. Maben, president of the Sloss-Sheffield Steel & Iron Co.; J. C. Thompson, president of the Republic Iron & Steel Co.; T. G. Bush, president of the Alabama Consolidated Coal & Iron Co.; and Chairman R. H. Edmonds, of the executive committee of the Tennessee Coal, Iron & R. R. Co. The local newspapers have published much in connection with the conferences that is not true. With a view to ascertaining the real situation as it stands, your correspondent interviewed President Maben late this afternoon. Mr. Maben said:

"Several conferences have been held with reference to the consolidation of the four companies you have mentioned. All that can be said now is that the negotiations with that object in view are progressing nicely. So far as things have gone, it looks very much as if the scheme will go through, but of course no one can tell what the future will bring forth. The financial interests that are pushing the consolidation are very well supplied with money, as is evidenced by their willingness to pay cash for the properties, and then formulate a plan by which everybody can come in. There is no truth in the report that some of the companies are raising barriers to the consolidation. As a matter of fact, all are in a receptive mood for it. I shall remain in New York for several days yet to be on hand in case an agreement is possible. If none is reached in a reasonable time, I will return to Birmingham."

When asked if any more Southern companies were involved in the proposed consolidation besides the forementioned, Mr. Maben replied:

"Not at present. The four will have to come to an agreement before any other companies will be absorbed. Then it may be that other companies will be acquired."

Speaking of the iron market, Mr. Maben said:

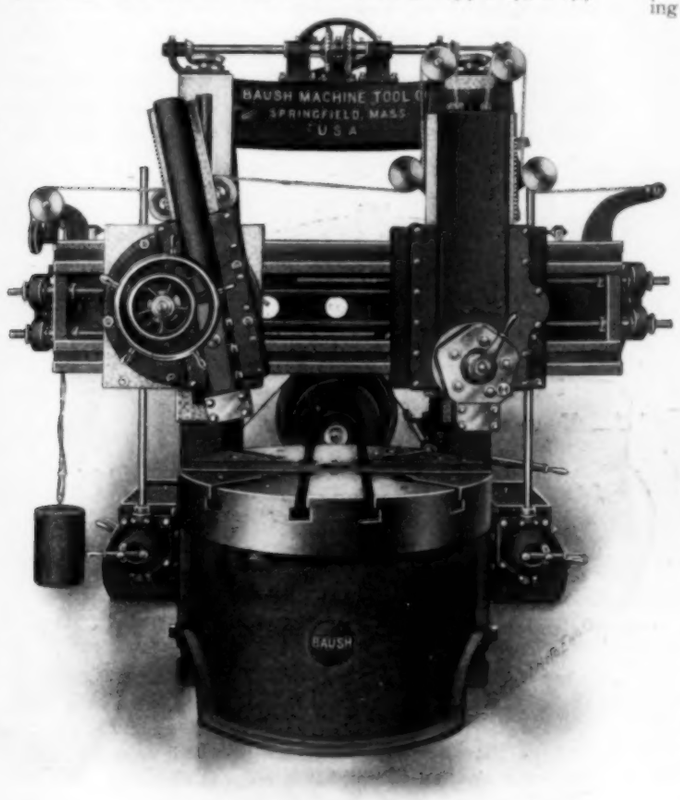
"Everything looks well for consumption increasing. The severe winter we have had has retarded improvement in the iron and steel industry greatly. Think of us having zero weather in Birmingham. Our sales of iron have been very good, however. Prices keep firm, No. 2 foundry selling at $13.50 Birmingham, and nobody is shading that price either. Now and then small lots sell at $13.75."

President W. B. Schiller of the National Tube Co. has presented the Lorain Public library a valuable collection of technical books, especially selected for the use of employes of the tube plant. The collection contains several hundred volumes.

Announcement has been made that the railroads will discontinue special export freight rates on steel on April 30. These rates went into effect in November, 1903, and were granted by the railroads to aid the steel manufacturers in the Fittsburg district in selling their steel products abroad. Now that the domestic consumption has grown to such proportions that much of the export business, except in a few finished lines, has been discontinued, the railroads have determined to temporarily abolish these rates.

A NEW 42-INCH MILL.

The Baush Machine Tool Co., of Springfield, Mass., has designed a 42-in. boring and turning mill. This machine has one turret head and one swivel head and has a capacity of 44 in. in diameter, 37 in. in height under the cross-rail or 31 in. under the tool holders. The table is 42 in. in diameter, is powerfully geared, and has ten changes of speed; five with back gears and five without. Maximum speed of table 20 r. p. m., minimum speed 6 r. p. m. The teeth on both table and pinion are steel, and are accurately planed. On the under side of the table there is an outer bearing nearly equal to the diameter of the base. The table spindle is 10 in. in diameter and 2½ in. long. It has a straight bearing in conjunction with an angular bearing to receive the side strains. There is also a thrust ball bearing on the lower step of the spindle as a preventive against any lifting tendency, and this relieves the table friction when heavy cuts are taken. The height of table from floor is 2 ft. 6 in. Tee slots in table are 1¼ x 2½ x 1¼



BORING AND TURNING MILL.

in. The turret slide can be set to bore, turn and cut 8 and 11¾ threads per in., and has a vertical movement of 24 in. The turret has five sides, is 10 in. across the flats, and has five 2 5-16-in. holes. The heads are entirely independent, both as to direction and amount of feed. The left hand head can be set at any angle and has a movement of 24 in. Either head can be brought to the center for boring and both have vertical movement of 24 in. The heads are attached to steel feed-screws by split nuts. These can be opened and a rapid movement obtained by ratchet and pinion engaging a steel rack on the cross-rail. The feeds are positive and have fifteen changes, from 1-64 in. to 61-64 in. horizontally, and 1-64 in. to 9-16 in. in angular and vertical directions. The cross-rail is raised and lowered by power, which can be done without revolving the table. The band brake operates on the main driving cone, by hand, and stops table instantly. The back gears can be changed by means of a lever, without the use of a lock nut. A plain table is ordinarily furnished with his machine, as illustrated; but a three or four-jaw independent and universal chuck can be supplied. This machine can be made with two regular swivel heads. The countershaft has tight and loose pulleys; driving pulley is 20 in. in diameter, for 4½ in. belt, and should run 300 r. p. m. This machine is self-contained, and therefore does not require an expensive foundation. The weight 16,200 lb. The floor space is 8 ft. 5 in. x 9 ft.

National Supply and Machinery Dealers' Association.

The National Supply and Machinery Dealers' Association was organized in Cleveland last week, with about forty representative concerns registered as members. Invitations will be extended to the leading companies in this line of business, throughout the country, to become members. The association aims to correct abuses in the trade, and in a general way promote the business interests of the members. The following officers were elected: E. E. Strong, president, Strong, Carlisle & Hammond Co., Cleveland; W. A. Somers, first vice president, Somers, Fitler & Tod, Pittsburg; Alfred Marshall, second vice president, Marshall & Huschart Machinery Co., Chicago. The officers, with the following gentlemen constitute the executive committee: Geo. Puchta, president of the Queen City Supply Co., Cincinnati; A. E. Brion, Peter A. Frasse & Co., New York; C. A. Strelinger, president of the C. A. Strelinger Co., Detroit; Geo. T. McIntosh, president the McIntosh Hardware Corporation, Cleveland. The secretary will be chosen by the executive committee, but this will probably not be done for some time, and in the meantime W. M. Pattison, of the W. M. Pattison Supply Co., Cleveland, will act as secretary. Wednesday evening a banquet was tendered by the Cleveland manufacturers and supply dealers to the visitors. Albert Reese Davis was toastmaster, and the following toasts were responded to: "Trade Associations," T. James Fernley, secretary-treasurer, Philadelphia National Hardware Jobbers Association; "Commerce," W. H. Boyd, Cleveland; "Good Fellowship in Business," Geo. D. McElwaine, Pittsburg; "Relations of the Press to the Trade," John K. Allen. The hosts were as follows: V. D. Anderson Co., Atlas Bolt & Screw Co., Avery Stamping Co., Bourne & Knowles Mfg. Co., Chisholm Steel Shovel Works, Cleveland Hardware Co., Cleveland City Forge & Iron Co., Cleveland Twist Drill Co., the Cleveland Cap Screw Co., Hill Clutch Co., Hart Mfg. Co., H. W. Johns-Manville Co., Lake Erie Iron Co., Lamson & Sessions Co., Loew Supply & Mfg. Co., Mechanical Rubber Co., National Acme Mfg. Co., National Screw & Tack Co., Osborn Mfg. Co., Oster Mfg. Co., Peck, Snow & Wilcox Co., Reliance Gauge Column Co., John A. Roebling's Sons Co., Standard Tool Co., W. S. Tyler Co., Union Steel Screw Co., Upson Nut Co., W. Bingham Co., Cleveland Tool & Supply Co., McIntosh Hardware Corporation, W. M. Pattison Supply Co., Strong, Carlisle & Hammond Co., White Tool & Supply Co., and Geo. Worthington Co.

The foundry connected with the plant of the Wm. R. Trigg Co., of Richmond, Va., which is now in the hands of a receiver, has been leased and will be operated by W. H. Woody Jr., and Chas. Winburne, under the name of the Shockoe Foundry Co. These men were both connected with the company before it passed into the hands of a receiver.

The Farmers' Bank & Trust Co., of Henderson, Ky., has sold the Frayser Foundry & Machine Works to J. F. Hite, of Owensboro, Ky.

THE CAMERON STEAM PUMP.

The selection of a steam pump requires most careful consideration, owing to the innumerable pumping problems which are almost daily arising. The early pumping engines were of the beam type without fly wheels and constituting the first adaptation of steam as a motive power. It was on them that Newcomen, Watt, Trevithick and others made their experiments and most important inventions. In a modified form, as in the Cornish engine, they attained fame and general use; in fact, for a long time they were the accepted standards for pumping engines, and to this day there are not a few of them either in actual use or standing in reserve.

It is a very general, though mistaken, idea that the question of steam economy in a pump is not of importance, and managers should not lose sight of the fact that a high consumption means more boiler power required, larger pipes and increased cost of installation. It cannot therefore be considered true economy to install cheap and uneconomical machinery, as any saving on this account is soon eaten up by the enhanced cost of the accessories and fittings.

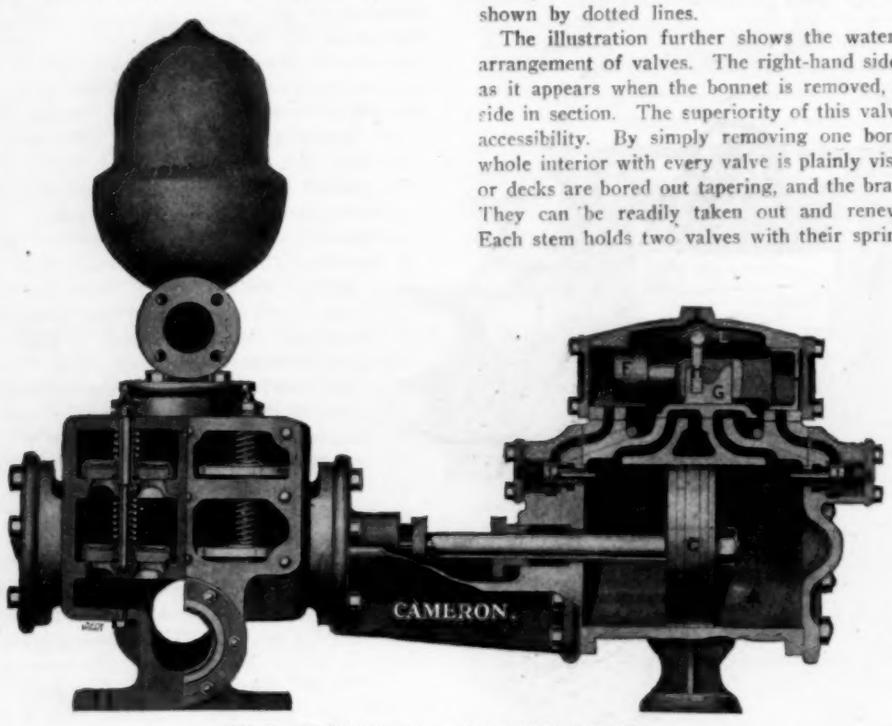


FIG. 1.—SECTIONAL VIEW OF A CAMERON PUMP.

The construction of the Cameron pump is shown by Fig. 1. This is a sectional view of a standard type pump, showing the steam end, the piston complete and the water end. Referring to the steam end: The plunger is reversed by two plain tappet valves and the entire mechanism consists of four stout pieces only, working in direct line with the main piston. It is simple and without delicate parts. Note: A is the steam cylinder; C, the piston; L, the steam chest; F, the chest plunger, the right-hand end is shown in section; G, the slide valve; H, a lever for reversing the steam chest plunger F by hand when this is expedient; II are reversing valves; KK are the reversing valve chamber bonnets; and EE are exhaust ports leading from the ends of the steam chest direct to the main exhaust and closed by the reversing valves II. The piston C is driven by steam admitted under the slide valve G, which, as it is shifted backward and forward, alternately connects opposite ends of the cylinder A with the live steam pipe and the exhaust. This slide valve G is shifted by the auxiliary plunger F; F is hollow and filled with stem which, issuing through a hole in each end, fills the spaces between it and the heads of the steam chest where it works. Pressure being equal at each end, this plunger F, under ordinary conditions, is balanced and motionless; but when the main piston G has traveled far enough to strike and open the reverse valve I, the steam exhausts through the port EE from behind that end of the plunger F, which immediately shifts accordingly and carries with it the slide valve G, reversing the pump. No matter how fast the piston may be traveling, it must instantly reverse on touching the valve I. In its movement the plunger F acts as a slide valve to close the port EE and is cushioned on the confined steam between the ports and steam chest cover. The reverse valves II are closed as soon as the piston C leaves them, by a constant pressure of steam, conveyed direct from steam chest through the ports shown by dotted lines.

The illustration further shows the water valve chest and arrangement of valves. The right-hand side is shown in full as it appears when the bonnet is removed, and the left-hand side in section. The superiority of this valve chest lies in its accessibility. By simply removing one bonnet or cover the whole interior with every valve is plainly visible. The shelves or decks are bored out tapering, and the brass seats forced in. They can be readily taken out and renewed at any time. Each stem holds two valves with their springs one above the other so that by simply unscrewing one plug and pulling up the stem both are released. It will be noticed that the valve chest is placed close to the ground and beside the water piston and not above it. The valves are therefore so much nearer the water and the suction lift is reduced accordingly. Every pump has two suction openings, one on each side, and the discharge opening can be turned on in any direction desired.

There are types and sizes of Cameron pumps for almost every requirement through the regular types will cope with any ordinary pumping problems, together with numerous combinations and proportions of the steam and water cylinders. Fig. 2 illustrates a Cameron pipe pattern plunger station pump, ready to be placed in the mines of the Montevallo Coal & Transportation Co. at Aldrich, Ala. This pump has a daily capacity of 500,000 gallons.

The Cameron pumps are manufactured by the A. S. Cameron Steam Pump Works, New York.

Henry Robertson, of Wadena, Minn., has leased a foundry and machine shop at Long Prairie, Minn., and expects to place it in operation soon.

David Fitzgerald will start a foundry and machine shop at La Grande, Ore.

CANADIAN INDUSTRIAL NEWS.

TORONTO, CANADA, Feb. 21.—The steel works of the Lake Superior Corporation at Sault Ste. Marie, Ont., are now receiving iron ore at the rate of about 35 tons a day from the Williams mine, a few miles distant. It is claimed to be of Bessemer quality and the output will shortly be increased. Another prospective source of supply is a mine situated about 25 miles below the Sault, which will be in operation before long. By utilizing these deposits the company hopes to be able to lessen the importations of iron from Michigan and Minnesota and ultimately to dispense with them altogether. The steel works are turning out daily between 350 and 500 tons of steel rails on their contract with the Canadian Pacific Railway and all industries of the corporation are now in operation excepting the mechanical pulp mill. The corporation has received the $60,000 for bounties on steel rails at the rate of $3 per ton from the Canadian Government, the question as to the liability of the latter under the act providing for such bounties upon "structural steel" having been decided in its favor.

The Dominion Iron & Steel Co., of Sydney, N. S., in pursuance of its decision to instal new electrical and steam power appliances, has let contracts to the Canadian General Electric Co., Toronto, and Goldie & McCulloch, of Galt. The Electric company's contract includes generators representing 600 kilowatts. The Galt firm furnishes two vertical engines of 850 h. p. each, having 150 revolutions per minute to be connected with alternating generators.

At the annual convention of the Canadian Mining Institute to be held at Montreal on March 1, 2 and 3, a large number of papers of scientific and practical interest will be read. Among those specially bearing on the iron industry are papers by Frank N. Speller, B. Sc., of Pittsburg, on the "Manufacture and Use of Wrought Pipe Threading and the Relative Durability of Steel and Iron Pipe;" by W. Blakemore, M. E., of Nelson, B. C., on the "Possibilities of Steel Manufacture in British Columbia;" by S. Ditton Mills, of Toronto, on the "Occurrence of Hematite North of Little Current, Georgian Bay," and by F. F. Snyder, Oak Park, Ill., on "Electric Furnace Construction.

The following companies have been incorporated under the laws of Ontario:

The Curtis & Neff Screw Co., Ltd., capital $30,000; head office Ingersoll, to manufacture screw machines, machine screws, etc. Provisional directors: Frank O. Curtis, John A. Neff and Earl A. Neff, all of Ingersoll.

The Huntsville Foundry & Machine Co., Ltd., capital $20,000; head office, Huntsville. Provisional directors: Jacob H. Johnson, Donald McK. Grant and Frank H. Tool, all of Huntsville.

The Canadian Pneumatic Tube Co., Ltd., capital $100,000; head office, Toronto. Provisional directors: Ernest P. Seton, Albert F. Lowry and John Alex. Soule, all of Toronto.

Whites, Ltd., capital $50,000; head office, Collingwood, to carry on business as hardware merchants and manufacturers. Provisional directors: Thomas J. White, James W. White, Wm. D. White, Helen S. White and Catherine S. White.

The Archer Light Heat & Power Co., capital $100,000; head office Toronto, to manufacture stoves, engines, electrical appliances, etc. Provisional directors: Robert B. Youngshusband, Isaac F. Moore, James M. Sinclair, Chas. B. Murray and Arthur W. Holmested, all of Toronto.

The Coxey Properties at Mt. Vernon and Massillon.

The Coxey properties, described in our issue of the 9th inst., have been the subject of some spirited bargaining. They were purchased at receiver's sale by H. N. Hills, of Gambier, O., who has received an urgent offer from Pittsburg parties for the foundry plant at Mt. Vernon, and from Ohio parties for the silica sand quarries at Massillon. Whether would-be purchasers of these properties will offer Mr. Hills sufficient inducements to give up his plans for the completion of the Imperial Steel Co., which he is forming to take them over, will probably be decided soon. Each property is said to be extremely desirable in its way. Mr. Coxey is said to have at one time refused to negotiate a lease of the foundry property at an annual rental of $75,000, and the sand quarries are reported to be generous money makers.

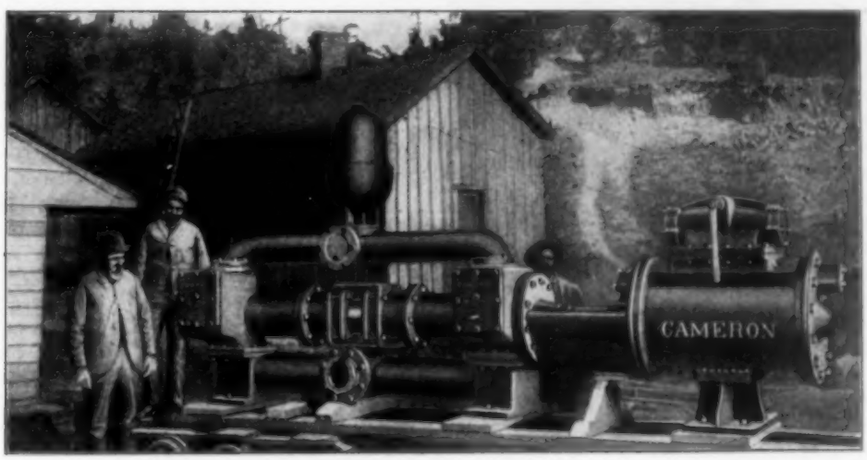


FIG. 2.—PIPE PATTERN PLUNGER STATION PUMP.

The Fairbanks Machine Tool Co., Springfield, O., a year ago added to its business a department for the manufacture of piano plates. A recent amendment of its charter changed the corporate name from the Fairbanks Machine Tool Co. to the Fairbanks Co., which gives a corporate name that is not misleading in any department of its business. Along with the piano plates the company will continue the same class of manufacturing that it has been engaged in heretofore, i. e., the making of grey iron castings, machine tools and special lathe, planer and shaper tools.

The management of the Tennessee Stove & Foundry Co., recently organized at Ridgedale, near Chattanooga, Tenn., expects to have the plant in operation about March 1, giving employment to 50 men at first and increasing the number as business demands. The plant consists of three large buildings, covering three acres.

DEWHURST SLAG LADLES AND CARS.

The Wellman-Seaver-Morgan Co., of Cleveland, has the sole American rights for the manufacture and sale of the Dewhurst slag ladles and cars. These ladles embody a number of distinctive features which will be noted by reference

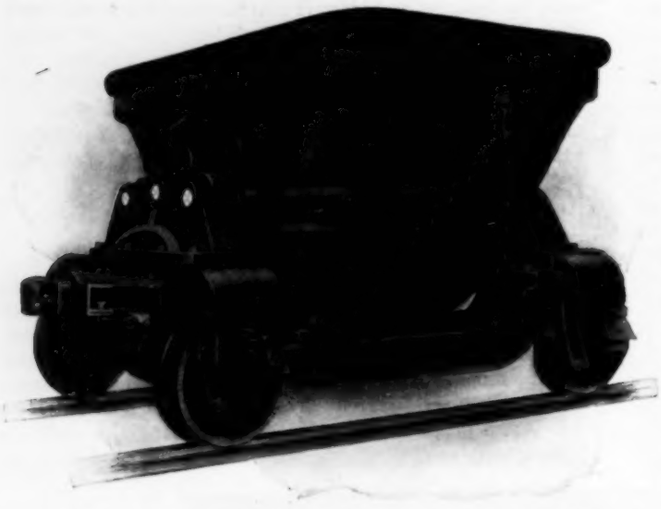


FIG. 1.—DEWHURST SIDE TIPPING, SINGLE TRUCK, SLAG LADLE AND CAR.

to the accompanying illustrations. Hand tipping is done away with; thus reducing cost of operation, and increasing the speed. The tipping device is at once simple and efficient. The ladles are tipped by a pull of the locomotive on the tipping chain. There are no power cylinders, gears, or tipping poles required.

The chain and tipping mechanism for side-tipping ladles can be placed on the side of the car where the dumping is to be done. The chain runs over steel snatch blocks and guide pulleys; the latter and two of the snatch blocks being attached to the car, and the other snatch block being attached to ladle as shown. The chain has hooks on each end; one for hooking to car and the other for hooking to locomotive. This chain may be hooked to either end of car, as required. The locomotive pulls away from the ladle while dumping. Hence if chain should break, the locomotive is not endangered, but will run away from the ladle instead of toward it. When the slag has been dumped, the ladle rights itself by gravity, by merely backing the locomotive. A train of side-tipping ladles can be tipped in series by attaching hook of each ladle to car ahead of it.

The end-tipping ladles are tipped by a direct pull of locomotive from opposite end of car, the locomotive pulling away from the car.

On all ladles a forged steel band is attached, running around the ladle slightly below the rim. By means of this band, the pull is evenly distributed around the ladle, thus obviating any tendency of the pull causing the ladle to spring outward at the front which might cause it to crack transversely. By fixing the tipping point high on the ladle, the leverage is increased and the tipping process made proportionately easier.

Double trunnions are cast on each side of the ladle and located slightly above the axis, so that the ladle will right itself from any point to which it might be tipped. Roller bearings support the trunnions and greatly reduce the power required for tipping. The ladles are of special shape, to facilitate the stripping of the slag and skull. Hence, in dumping, the skull follows the molten slag, requiring no hand work for its removal. The whole of the work is handled by the locomotive and its crew. The ladle is cast in a single piece, and heavily ribbed on the outside to stiffen it and increase its strength. There are no ladle linings to require renewal. The absence of linings also obviates all possibility of skulls pulling out linings in dumping.

The cars are built for standard gauge tracks and are equipped with either four or eight wheels as may be required. They are built in a variety of sizes, ranging in capacity from 70 to 280 cu. ft. in the side dumping pattern, and from 70 to 210 cu. ft. in end dumping pattern, the 210 cu. ft. car of each being the standard size.

Record Breaking Railroad Earnings.

The compilation of the *Financial Chronicle* of gross earnings of the railroads of the United States for the calendar year, 1904, shows that on 135 reported roads, with a mileage of 179,668 miles, the receipts amounted to $1,773,338,878, as compared with $1,762,201,391 on a mileage of 176,492 in 1903. All the prominent companies did not make a gain over 1903, but the railroad system as a whole did.

"The circumstances is certainly remarkable," the *Chronicle* states, "considering how heavily railroad earnings were reduced in the earlier months of the year, and considering also that general trade, in part as the result of the presidential canvass, was quiet and inactive until toward the close of the period, and that the iron and steel industry remained in a state of depression until September, when marked revival came.

"There were in addition, it will be remembered, a number of special disturbing influences which operated to reduce the volume of railroad traffic for the time being, such as the masters and pilots' strike on ships plying on the great lakes and the strike at the beef packing establishments. That it should have been possible to show an increase in the gross revenues of the roads, notwithstanding all of these drawbacks, evinces most assuredly marked recuperative power on the part of both railroad and industrial interests. What invests the result with additional significance is that the level in earnings reached in 1903 was large beyond precedent."

It is stated in Philadelphia that the Pennsylvania Railroad will buy new equipment costing not less than $23,000,000 this year for its lines east and west of Pittsburg, and if

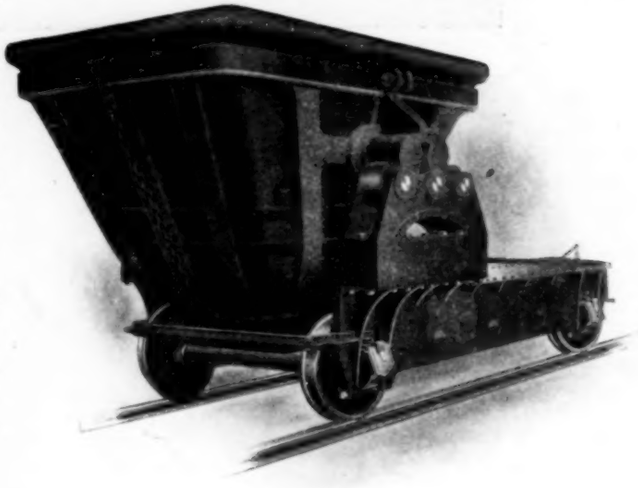


FIG. 2.—DEWHURST END TIPPING LADLE AND CAR.

the entire program is carried out as arranged, the cost will be $27,000,000. Already contracts have been placed for 12,300 cars, and it has been decided to order 3,000 additional freight cars. In addition to the 370 locomotives ordered, the Pennsylvania Railroad has arranged to build 150 locomotives in its Juniata shops.

NOTES ON STEAM TURBINES.*

BY FREDERICK C. BATES.

When we view the turbine historically, I am reminded of a paper once read before a learned society, entitled "Modern Inventions which the Ancients Stole"—for as the Chinese had removable type long before the days of Gutenberg—as the Egyptians had their incubators long before our own time—so did the ancients have their Aeolipile, or Ball of Aeolus, often described as the first steam engine, and certainly the germ of the steam turbine. This mechanical toy (for it was probably not much more), was built by Nero of Alexandria, the leading Greek mathematician and physicist of his time. Not only are the dates of his birth and death unknown, but there is great uncertainty even as to the century in which he lived, although it is believed to have been the first century A. D. From the time of Nero we hear nothing of the turbine until 1629, when Giovanni Branca, an Italian engineer, invented his impulse wheel, which consists simply of a jet of steam impinging upon the vanes of a paddle wheel and blowing it around. Practically no substantial results were obtained until the last quarter of the 19th century, when Parsons, De Laval, Curtis and others began their experiments.

The De Laval turbine was originally built to run cream separators, but soon recommended itself to the operation of electric generators. In the De Laval machine we find a single combination of nozzles and a wheel attached to the shaft carrying buckets on the rim. The total power of the steam is devoted to the production of velocity in an expanding nozzle, for in the De Laval type it is necessary to fully expand the steam in the nozzle before it enters the buckets, thus transforming most of the heat of the steam into kinetic energy As the work in the De Laval turbine is done by the impact (not the expansion) of the steam, a peripheral speed of about 2,000 ft. per sec. should be used to obtain maximum economy. In actual practice about 1,200 ft. per sec. is attained, bringing the rotating speed to about 30,000 r. p. m., necessitating a special form of shaft and bearings which have been worked out with great ingenuity and perfection by the designers and manufacturers. It is, of course, impracticable (if not impossible) to operate direct connected dynamos at such high speeds, and gears must be used.

The Rateau turbine is briefly one in which there are a number of combinations of nozzles and bucket wheels mounted side by side on the same shaft, and driven successively by the same current of steam. A recent blue print of a Rateau machine showed 25 wheels and 25 sets of directing nozzles.

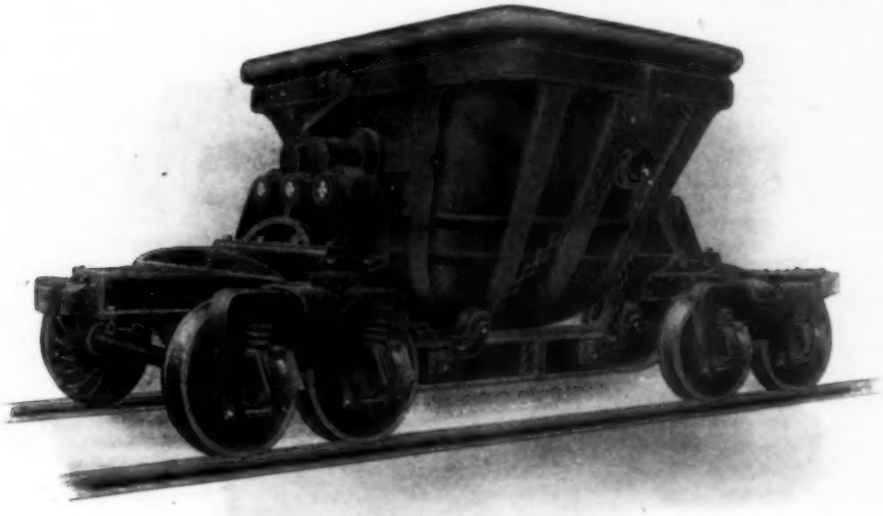


FIG. 3.—DEWHURST DOUBLE TRUCK, SIDE TIPPING, SLAG LADLE AND CAR.

The work done in a steam turbine is developed by the kinetic energy of particles of steam which are given a high velocity by reason of the steam expanding from one pressure to a lower pressure. When we consider that steam passing from 150 lb. to atmospheric pressure may attain a speed of approximately 3,000 ft. per sec., and that it may reach even 4,000 ft. per sec. when passing from 150 lb. to vacuum, we may then realize the difficulties of constructing within safe mechanical limits a prime mover which depends largely, if not wholly, upon this peculiar property of steam. Since the theoretical condition of maximum economy exists when the jet of fluid moves with a velocity equal to about twice that of the vane against which it acts, a peripheral speed of approximately 2,000 ft. per sec. would be necessary in order to obtain the best results when condensing. This is, of course, a peripheral speed which does not permit of practical operation, and the problem has been treated in various ways. There are four turbines at the present time which are being offered commercially, namely: the Parsons, the De Laval, the Reteau, and the Curtis, all named for their several inventors.

*Read at the recent meeting of the Engine Builders' Association of the United States.

The proper adjustment of these 25 elements and their clearances with variable shaft temperatures must be extremely difficult. These machines are being built by Sautter-Harle, Paris.

In the Parsons machine the steam finds its way through a number of successive buckets without being carried through nozzles, requiring a very large number of buckets with rows of stationary buckets between them. The Parsons machine is characterized by the essential bulk, weight and complication incident to the use of so great a number of buckets as are found necessary. In the 300 kilowatt Parsons turbine there are about 31,000 buckets.

Still another type of turbine was brought out in 1895 by C. C. Curtis, of New York. The machine is now being built by the General Electric Co. in sizes varying from 1¼ to 5,000 kilowatts capacity, both in direct and alternating current, and in horizontal and vertical types according to size.

The Curtis turbine retains some of the features of its predecessors, but new ideas are introduced permitting moderate peripheral speeds, lower rotative speeds, less weight, fewer and simpler parts, high efficiency and lower cost. Velocity is imparted to the steam in an expanding nozzle

designed to efficiently convert nearly all the expansive force into velocity in the steam itself. After leaving the nozzle the steam passes successively through two or more lines of vanes on the moving element which are placed alternately with reversed vanes on the stationary element. In passing successively alternately through these moving and stationary elements, the velocity of the steam acquired in the nozzle is fractionally abstracted and effectively transmitted to the revolving part of the machine.

The nozzle generally comprises many adjacent sections placed opposite to the intermediate or stationary buckets, and delivers steam to the bucket wheels in a broad belt when all nozzle sections are in flow. The velocity of the jet leaving the nozzle is about 2,000 ft. per sec., and the peripheral speed of the bucket wheel is about 400 ft. per sec., varying somewhat according to size.

The turbine is divided into stages, each of which may contain one, two or more bucket wheels supplied with steam from a set of nozzles. The number of stages and the number of bucket wheels per stage is governed by practical and theoretical conditions. Low rim speeds usually necessitate more stages, or more bucket wheels, or both. Our usual practice is to so sub-divide the steam expansion as to permit each stage to handle an equal amount of the total power of the steam. The absolute pressures in the four shells when condensing with an initial pressure of 165 lb. absolute, and a condenser pressure of 2-in. mercury will be about 58 lb., 18 lb., 5 lb., and two in. mercury for the four stages respectively.

For turbines of large capacity we have applied these principles to the development of a turbine with a vertical shaft. By this arrangement, all imposition of weight on cylindrical bearings and all tendency to shaft deflection is avoided; consequently, the machine is free from difficulties due to irregularity of expansion or imperfection of support, and no problems of lubrication are involved other than those of supplying lubrication to the step bearing.

The step bearing consists simply of two cylindrical cast iron plates bearing upon each other, with a recess about the center to receive the lubricating fluid which is forced in with sufficient pressure to sustain the weight of the revolving part. Oil was used for the lubrication of the step bearing with the early forms of machines, but water has since been substituted. The water is supplied by steam or motor driven pumps, and is returned from the step bearing through the exhaust base into the condenser. The use of water eliminates steam packing of the step bearing, and totally avoids the use of oil for the turbine proper.

The pressure on the step bearing varies from 300 to 1,000 lb. per sq. in. according to the capacity of the machine. The mechanical friction is so small that the revolving part of a 5,000 kilowatt turbine, including bucket wheels, generators, etc., and weighing approximately 135,000 lb. may be made to rotate by a slight pull with one finger on one of the wheels.

The governing is effected through the increase or decrease of the active steam belt by successively opening or closing the first stage nozzles. In order to provide for exceptional conditions, such as wide and sudden fluctuations of load, the second stage is provided with a set of nozzles which are opened and closed automatically by the steam pressure of the first stage. A centrifugal governor attached to the top of the shaft imparts motion to levers, which in turn operate the valve mechanism. The cone valves are partially balanced by steam, and are each opened or closed by a small by-pass valve which is operated by a solenoid, which in turn is energized by a relay current through a small controller connected to the governor. Unlike the governor to which we are accustomed in steam engine practice, this governor performs its functions with little or no mechanical effort. In addition to the governor mechanism, the turbine has an emergency device which closes a butterfly valve in the main steam pipe when the speed of the machine exceeds 10 percent of normal. This device also lets air into the exhaust chamber, thus braking the wheels and slowing the machine down more rapidly.

While the Curtis turbine compares favorably with steam engines or other steam prime movers at low degrees of vacuum, the advantage of high vacuum is so great that every effort should be made to obtain it. The larger sizes are intended to operate condensing, but they will all carry full load when non-condensing. Some of the larger sizes of the Curtis turbines have been designed with condensers in the sub-base, the exhaust steam falling directly on the tubes. This makes a very compact machine, requiring comparatively much less floor space than is required when a separate condenser is used. When surface condensers are used with Curtis turbines, the condensed water can be returned directly to the boilers as it is entirely free from oil. The possibility of so returning the water is the greatest practical value. In other makes of steam turbines oil is generally introduced in connection with balancing pistons or steam packing, and therefore this great advantage cannot be realized. Much has been said concerning the expanse of the condenser installation, but it is believed that investigation will prove that good results can be obtained with apparatus which has not heretofore been used extensively for this purpose. In a paper read before the American Society of Mechanical Engineers in New York, on Dec. 6, George I. Rockwood of Worcester, Mass., describes the injector or ejector condenser in use at the Atlantic Mills, Providence, R. I., in connection with the installation of a 400 kilowatt Westinghouse-Parsons turbine. It is interesting to observe that this injector condenser costs, fully installed, with centrifugal circulating water pump, tank piping and valves, about $2.50 per kilowatt as compared with from $7 to $10 per kilowatt with the surface condenser system. With the injector condenser which Mr. Rockwood describes, they had no difficulty in maintaining a vacuum of 28 to 28½ inches.

The Curtis turbines can be operated without injury with very high steam temperature, and it is therefore possible to use high pressure and high degrees of superheat in order to obtain the greatest economy.

Some interesting data covering the four different types of machines of approximately 300 and 500 kilowatt capacity appears in the following table:

Type	Rows of Rotating Bucket Wheels	Steam Velocity feet Per Second	R. P. M.	Rim Speed feet Per Second	Buckets
Parsons,	35	400	3,600	200	Inserted
Rateau,	24	800	2,400	400	Inserted
Curtis,	8	2,000	1,800	400	Solid
De Laval,	1	4,000	20,000	1,200	Inserted

The speeds adopted for the Curtis turbines are such as to give the very best results in the design of the generators; consequently the General Electric generators for operation with turbines have the greatest efficiency and the best electrical constants, and are so proportioned that they will carry heavy overloads without injurious heating. They have the highest efficiency of any electrical generators that have been produced, with the possible exception of some large high speed generators for use with water turbines.

Various advantages of the Curtis turbine have already been mentioned. They may be summarized as follows: High steam economy at full loads; high steam economy with rapidly fluctuating loads; small floor space per kilowatt capacity, reducing to a minimum the cost of real estate and buildings; low cost of foundations; uniform angular velocity, thus allowing for parallel operation of alternating current generators, and the operation of rotary converters without hunting; simplicity in operation, and low expense for attendance; freedom from vibration; adapted to high steam pressure and high superheat without practical difficulty, and with consequent improvement in economy; condensed water is kept entirely free from all oil, and can be returned to the boilers.

PRESSED STEEL CAR CO.

The Pressed Steel Car Co. has issued its report for the fiscal year ended Dec. 31. President Hoffstot says that the abnormal condition of the car building business in 1904, there having been no such depression in the company's business since 1893, accounted for gross sales last year being only $4,498,268, a loss on the year's transactions of $707,110. The operations of the two years compare as follows:

	1904.	1903.	Changes.
Loss for year	$707,111	*$2,768,898	Inc. $3,476,009
Dep'n and ren'ts	80,000	260,000	Dec. 180,000
Balance loss	$787,111	*$2,508,898	Inc. $3,296,009
Charged against previous year	.....	21,392	Dec. 121,392
Chgs. invty. adjm.	.....	650,000	Dec. 650,000
Charges	.....	771,392	Dec. 771,392
Balance loss	$787,111	*$1,737,506	Inc. $2,524,617
Preferred dividends	875,000	875,000	.....
Common dividends	375,000	625,000	Dec. 250,000
Total dividends	$1,250,000	$1,500,000	Dec. $250,000
Deficit	2,037,111	‡237,506	Inc. 2,274,617
Previous surplus	4,568,985	4,331,479	Inc. 237,506
Net surplus	$2,531,874	$4,568,985	Dec. $2,037,111

*Profit. ‡Surplus.

The condensed general balance sheet, as of December 31, compares as follows:

Assets—	1904.	1903.	Changes.
Prop'ts and plants	$26,043,767	$26,063,190	Dec. $19,423
Stocks owned	1,712,881	2,110,646	Dec. 397,765
Taxes and ins.	22,057	16,620	Inc. 5,437
Accts. receivable	493,251	857,670	Dec. 364,419
St'ck & ma'rial on h'd	2,164,390	1,536,407	Inc. 627,983
Cash in banks	2,130,517	3,527,165	Dec. 1,396,648
Totals	$32,566,863	$34,588,898	Dec. $2,022,035
Liabilities—			
Common stock	$12,500,000	$12,500,000	.....
Preferred stock	12,500,000	12,500,000	.....
Five per cent mortgage gold notes	3,500,000	3,500,000	.....
Purchase money mortgage	310,000	310,000	.....
Accounts payable	844,997	797,570	Dec. 47,427
Accrued salaries and wages	88,255	120,606	Dec. 32,451
Accrued interest	72,988	72,988	.....
Accrued pfd divs.	218,750	218,750	.....
P. and L. surplus	2,531,873	4,568,984	Dec. 2,037,111
Totals	$32,566,863	$34,588,898	Dec. $2,022,035

In explaining the poor showing of the year the report says: "The average requirements by railroads and other users of freight cars for replacement and new equipment is about 195,000 cars per annum. During the year 1903 only about 110,000 cars were ordered, and most of these in the early part of the year, so that the car building companies (at least those that were on time with their deliveries) practically completed their orders before the year 1904. During the year 1904 only about 130,000 cars were ordered, and fully 70 percent of these orders were placed during the last three months of the year. There was, therefore, no time to complete the construction of most of the cars ordered last year, consequently they do not figure in last year's receipts. In the two years 1903 and 1904 there were nine or ten months in which few orders were given at all."

President Hoffstot continues: "These abnormal conditions of the car building business account for the gross sales for 1904 being only $4,498,268.61, and as a result we lost on the year's business $707,110.68. This loss is easy to account for when it is borne in mind that your company's plants have heretofore done upwards of $33,000,000 worth of business in one year. It may be interesting to you to know to what extent this depression affected your company's business compared with other years. Our sales over a period of years have been as follows:

1899	$14,108,212
1900	22,540,115
1901	23,032,491
1902	33,883,519
1903	26,601,249
1904	4,498,268
Total	$124,663,855

on which business we earned $13,773,607, and from these earnings paid out $5,250,000 in preferred dividends and $2,750,000 in common dividends, besides charging off $3,241,733 for depreciation, adjustments, etc."

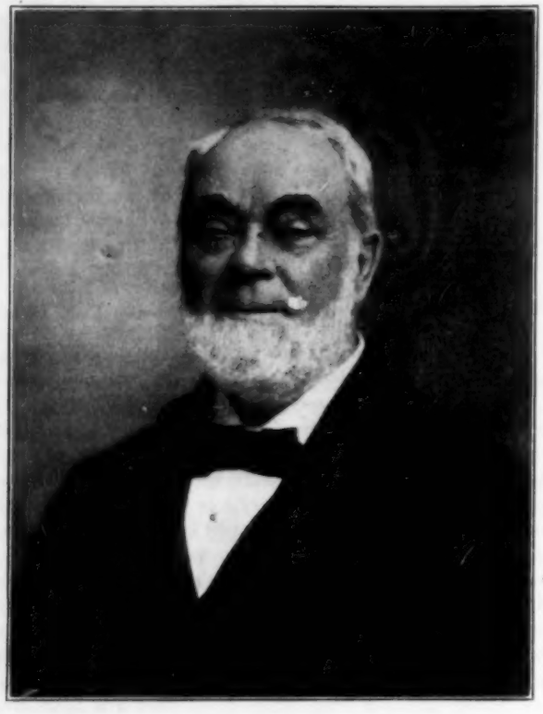
President Hoffstot reviews the conditions existing at the time of the resumption of orders in the year 1904 and described the competition to get business among car companies as being so keen that most companies took orders at almost any price. The policy of the Pressed Steel Car Co. seems to have been to keep its organization and not participate in the general condition of demoralization which then existed and to wait until the normal conditions appeared again. In January, 1905, more than eight millions of dollars' worth of business was on the books of the company—almost twice as much as was done throughout the entire year of 1904. The report goes on to show that considerable improvement was made in the plants of the company during the year 1904, including the addition of a plant for the manufacture of tank cars and a further plant for the automatic manufacture of arch bars. Reference is made in the report to a strong alliance with the car company of Canada, known as the Canada Car Co., Ltd.

Some discussion appears to be going on in New South Wales as to whether locomotives for the railways should be built abroad or at home. Toward the close of the last New South Wales parliament, the then premier called for tenders for the manufacture within the state of 60 locomotives; but owing to a change of ministry the subject was allowed to remain in abeyance. It seems that the importation of locomotives is still going on, and would not be stopped except for the purpose of experiment at the railway workshops, a matter which has not been decided upon. It is stated that local manufacture at the prices which have been submitted means that the railway commissioners would be called upon to pay between £1,200 and £1,300 per engine more than the price at which they would get the best locomotives that are built from abroad, and delivered in steam on the rails at Eveleigh, Sydney; while, if these locomotives were built in the Eveleigh shops it is officially estimated that they would cost something like £800 more than they could be obtained for abroad. The railway commissioners advise the government that locomotives should not be locally built in view of the extra burden that would have to be borne by the railways, but although not approving of such a course, it is their opinion that if locomotives are to be built in the state, the experiment should be made at the Eveleigh shops.—[Railway Age.

The Belfort Iron Works Co. Ironton, O., has built an entirely new furnace on the site of the old one which it tore down last fall. The present stack is new from top to bottom, and the company has at the same time made general repairs all through the plant in the matter of putting in complete order of its blast stoves, boilers, engines, etc. The furnace is now in operation, having been put in blast about the middle of last week. The furnace is 65 ft. high, 16 ft. bosh, and 10 ft. hearth.

THE LATE EDWARD LEWIS.

Edward Lewis, a pioneer iron master of Ohio, died at his home in Cleveland Feb. 15, aged 86 years. Mr. Lewis was born in Malmsbury, England, in 1819. He came to the United States early in life, located in Cleveland and began his business career in the iron and hardware store of W. A. Otis in 1841. After a few years he became connected with forges on Whiskey Island, which plant was built in 1852 by Otis & Ford and was an important factor in the industrial life of the then small city of Cleveland. It was the first plant of its kind built west of the Mahoning Valley. Prior to 1852 the iron used in that city was hauled in wagons from New Castle and Pittsburg. At first only forging was done, but a rolling mill was built in 1858 and about 1,000 tons of iron was rolled each month. At that time the owners were W. A. Otis, his son, Charles A. Otis, Edward Lewis and S. Wilder. In 1872 W. A. Otis retired and the other members of the firm with W. C. and C. W. Scofield organized the Lake Erie Iron Co. In that year the plant was destroyed by fire and rebuilt. The



EDWARD LEWIS.

product of the new plant was increased to 3,000 tons per month, there being 16 puddling furnaces, 15 heating furnaces, 4 trains of rolls and 10 hammers. In 1879, nut and bolt works which turned out 10 tons daily were added to the property of the company, but not at the old site. In 1898 Mr. Lewis sold his interest to the Scofields, who ran the old plant for a few months and then sold it to the Republic Iron & Steel Co. This company operated the plant for about two years and then closed it. The machinery was taken to other plants owned by the Republic company and the plant was razed in 1902. The new plant of the Lake Erie Iron Co. is one of the important industries of Cleveland. Mr. Lewis was connected with the old plant fro mthe time it was built in 1852 until he retired in 1898, being vice president and general manager. In the early forties, before the mill was built, to meet the demand for bar iron in Cleveland, that product was hauled from Pennsylvania and sold as high as $80 per ton. The works passed through several periods of depression and were idle during twenty-one of the forty-eight months of Buchanan's administration. The war and the Morrill tariff, however, put life into the business and after 1861 the mills enjoyed many prosperous years. Mr. Lewis enjoyed excellent health until a few weeks before his death, which was due to pneumonia. He is survived by one daughter, Mrs. C. H. Weed.

Value of Sound Technical Education.

"Technical training is becoming of vastly more importance than ever before, and those nations which are offering the best technical training to their youths are making the most rapid industrial progress," says Frank A. Vanderlip in March *Scribner's*. "A study of the international field brings that fact out with perfect clearness. Where education is lacking industry is lagging; where education is stereotyped industry is without initiative. The necessity for thorough education and the best technical training has become almost as great in commercial affairs as it has in the industrial field. The methods of commerce today cannot be as easily compared with the methods of a generation ago as can the process of industry now and at that time, but I believe that the changes in the methods of commerce have, in many cases, been as radical and the improvement as great as in the field of industry. Two generations ago the trained engineer was looked on with disfavor by the practical industrial manager. The man who grew up in the business was thought far superior to the man who got his knowledge from books. The necessity for a technical engineering training is now universally recognized, and no important industrial operation would be undertaken without the aid of technical experts. I believe the same change is coming in commercial life. The commercial high schools of Germany and the start in higher commercial education which we are making in this country are the forerunners of great technical schools of commerce. These schools will turn out men with as superior qualifications for commercial life as have the graduates of the great technical institutions in their special field. I believe the great masters of commerce will come to recognize the necessity for and the practical advantage of such commercial training, just as the captains of industry have long ago recognized the value of technical training for engineers."

Belgium is getting some steel orders that are encouraging. Consul McNally reports that large orders for railway material and structural iron have been placed in Liege by firms in Argentina. They are divided among four of the principal mills and are being expedited as rapidly as possible. These, as well as other outside orders, have encouraged the manufacturers of steel and iron material to improve their works, and to replace old plants with modern, up-to-date machinery of extended capacity, and capable of meeting demands for quick delivery. Two important steel works of Liege are at present working on an order of 6,800 tons of street rails for English firms.

The Maryland Steel Co. has lately sold a quantity of steel rails, said to be about 2,000 tons, for shipment to Porto Rico. They are understood to be for the American Railroad Co. of Porto Rico.

The will of John B. Scully, the steel and iron merchant of Chicago who died February 5, has been filed. Personal property is valued at $189,500, the real estate at $13,000. The estate is left to the widow, daughter, and other relatives.

John S. Lairy has brought suit against the Dorner Truck & Foundry Co., Logansport, Ind., demanding that a receiver be appointed.

OBITUARY.

Henry Tod, aged 67, one of the best known iron men and capitalists of Youngstown, died Feb. 20 after an illness of four months. He leaves, besides his widow, one son, John Tod. Henry Tod was the second son of Governor David Tod, who served the state during the civil war. He was born at Warren, O., June 14, 1838. At the age of 21 he was manager of the Brier Hill furnaces and was throughout his life prominently connected with manufacturing concerns of the Mahoning valley. He was vice president of the Brier Hill Iron & Coal Co. and allied interests, vice president of the First National bank, Youngstown, and director in the Mahoning National bank, the Ohio Leather Co., the Youngstown Steel Co., the Youngstown Carriage & Wagon Co., and a stockholder in many other industrial concerns in that city and elsewhere. His youngest son, Henry Tod Jr., was killed Oct. 8, 1902 in an automobile struck by an Erie train. He never completely recovered from the shock and sorrow which this catastrophe brought to him.

James R. Ashley, a pioneer wire manufacturer of Joliet, Ill., died Feb. 11, aged 80 years. Mr. Ashley was born Feb. 3, 1825, at Martinsburg, N. Y. In 1837 he moved with his father to Joliet, one month being required to make the journey overland. In 1874 he formed a partnership with H. B. Scott and Wm. Watkins for the purpose of manufacturing wire fence. The partners operated together until 1876, when they organized the Joliet Wire Fence Co., taking in several new members. In 1879 Mr. Ashley, with Mr. Scott and Daniel Robertson, organized the firm of H. B. Scott & Co., who purchased the business. Mr. Ashley continued an active member until 1881, when he disposed of his interests and retired from the firm. Meantime he organized another firm under the name of the Joliet Wire Co., which was capitalized at $50,000. It operated a wire drawing department, the first to be installed west of Cleveland up to that time. In July, 1882, Mr. Ashley purchased the machinery of the Joliet Wire Co., and entered into an 8-year contract with the state, employing 125 convicts. The company manufactured barb wire, fence staples, wire nails and market wire. In 1890 Mr. Ashley erected another plant, which was operated until 1893, when it became the property of the American Steel & Wire Co.

Samuel Lawrence Barriett, a well known manufacturer of electrical machinery, of Cincinnati died suddenly in Dayton, O., Feb. 14. He was president and treasurer of the Barriett Electric Co.

Henry Doyle, superintendent of the tube mill of the Youngstown Iron Sheet & Tube Co., died at Youngstown, Feb. 21, after a long illness. He was born in Wheeling, W. Va., forty-eight years ago.

George Bingham, of Pittsburg, aged 81 years, died on Feb. 18 after a short illness. He was one of the pioneer manufacturers of Pennsylvania. Until a year ago Mr. Bingham was president of the Phoenix Galvanizing Co., of Pittsburg.

Norton P. Otis, chairman of the board of directors of the Otis Elevator Co., former mayor of Yonkers, N. Y., and representative in Congress of the Nineteenth District of New York, died Feb. 20 at his home in Yonkers of cancer. Mr. Otis was born March 18, 1840, at Halifax, Vt. At the age of 18 he entered his father's elevator works and was subsequently connected with the business in various capacities, being successively treasurer, vice president and president, and finally chairman of the board of directors. In 1880 he was elected mayor of Yonkers. In 1883 he was elected to the Assembly, and was a member of the Committee on Cities, of which President Roosevelt was then chairman. He was president of the New York State Commission to the Paris Exposition of 1900.

The Red River Furnace Co., at Clarksville, Tenn., expects to go in blast by or before March 15.

FRIGHTFUL LOSS OF LIVES IN MINES.

A disastrous explosion occurred in the coal mines of the Alabama Steel & Wire Co., at Virginia mines, six miles south of Bessemer, Ala., on the afternoon of Feb. 20. About 160 men, most of them white, were at work in the mine, far under ground and beyond the sound of the human voice. The explosion, caused by a "dry shot," completely closed up the entrance to the mine, the noise arousing the entire mining camp. It is hardly possible that any of the entombed men can escape alive, as those who are not killed by the explosion would be suffocated by the gases. A large gang of men was at once organized to open the entrance to the mine, relays being used as the men became tired or overcome by the afterdamp. So far, over 50 bodies have been recovered, many of them so badly disfigured that the only means of identification was the information given by Mine Boss Reed, who knew the room in which each man was working. One of the victims showed faint signs of life, and every effort was made to bring the man to consciousness, but it is thought he cannot recover.

Port Arthur is Favored.

Although not officially announced, it is understood from reliable sources that final arrangements between the Atikokan Iron Co. and the town of Port Arthur, Ont., securing the erection of a blast furnace of 100 tons capacity in that town were made on Feb. 16. The capital to be invested in the enterprise is $1,000,000, of which $400,000 is furnished by Mackenzie & Mann, of the Canadian Northern Railway, and $300,000 by the town of Port Arthur, the rest being subscribed by American capitalists. The town also furnishes a site of 40 acres. The company will be supplemented by the Canadian Coal & Ore Dock Co., which will construct ore docks at a cost of $500,000.

A circular from Secretary F. R. Hutton of the American Society of Mechanical Engineers submits several reasons for the continuance of the coal testing plant at St. Louis. A complete description of the plant was published in *The Iron Trade Review* of Feb. 16. Members of the society are asked to write to their respective members of Congress and urge their favorable action upon an appropriation of $200,000 for the purpose of carrying on the work. The testing plant is under control of the United States Geological Survey and the experts in charge are Edward W. Park, chairman; J. A. Holmes and Marcus R. Campbell.

A change has been made in the date of what should have been the February reunion in New York of the American Society of Mechanical Engineers. To suit the convenience of the lecturer, it is assigned for Thursday, March 2, and the subject of the address will be "The condition at Panama, and the reasons for a sea level canal." The lecture will be illustrated and will be delivered by Worcester R. Warner, of Warner & Swasey, Cleveland. Mr. Warner has visited the Isthmus and has made at first hand an investigation of a question of national importance. The subject is most timely and of especial interest to engineers.

On March 31, Prof. Barnes, of McGill University, will discuss some experiments connected with the phenomena of ice below the surface of water in streams. James M. Dodge and G. C. Henning are assigned to the reunion meetings of April and May, respectively, but the subjects of their addresses are not yet announced.

R. B. Ridgley, jobber, at 14 Atwater street, East, Detroit, has added a store room at 14 Atwater street, West, for the handling of soft steel. This concern has increased its business largely during the past year.

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BASIC OPEN-HEARTH STEEL WITHOUT SCRAP.

The success of the practice at Ensley, Ala., whereby what is substantially the basic open-hearth steel process is carried on without the use of scrap, is worthy of attention. One of the vital problems in the development of the steel industry is the question whether the increase in basic open-hearth steel manufacture will be checked by the obvious inadequacy of the scrap supply for indefinite expansion in that direction. Open-hearth steel production has doubled four times in the past fourteen years. While Bessemer steel production has in several years shown a decrease, open-hearth steel production has not shown a single decrease since, nearly 20 years ago, the annual production first passed 200,000 tons.

Solutions to the problem of open-hearth steel without scrap were in the past few years supposed to have been found in the use of direct metal and in the employment of certain other means. However successful these may have been from a purely technical standpoint, they have not prevented the market for heavy melting scrap reaching a parity with pig iron, and in some cases passing it. The leading steel interest has itself made several purchases of heavy melting stock at higher delivered prices than Bessemer or basic pig iron. By the scramble to obtain scrap the position of the scrap factor has been changed from that of a merchant doing what was in essence a brokerage business, to a dealer who is in substance a speculator against the advances and declines in the whole crude material market.

That further expansion in the basic open-hearth steel industry will not be lightly curbed by the deficiency in the scrap supply, is a certainty. The industry has shown wonderful vitality. Its first extensive use was at Pittsburg in 1895, when its employment was induced by the fact that very cheap Southern basic pig iron could meet scrap arising out of Bessemer steel manufacture. The Alabama pig iron was regarded simply as a convenient means of utilizing this scrap.

The basic open-hearth steel industry is no longer a mere convenience for the utilization of what was substantially a by-product. It has a vitality of its own. Instead of Alabama basic pig being made into steel at Pittsburg, it is kept in Alabama and there made into steel, despite the fact that there is no adequate scrap supply in the South, largely because the South is too recent a consumer of steel.

It is at Ensley, Ala., that the most radical innovation has been made in the practice of the basic open-hearth steel process. The plan starts with the idea of furnishing the regular furnaces with mixed direct metal, but goes farther than this in partially desiliconizing and decarburizing this mixed metal, and furnishes the regular furnaces in addition metal which has been blown in a standard Bessemer converter. What is simply a metal mixer in the North is at Ensley a 250-ton rolling open-hearth furnace, known as a "primary" furnace, while there is provided in addition a standard 15-ton Bessemer converter. With these adjuncts there is furnished the regular basic open-hearth furnaces a metal which requires the removal of but little silicon and carbon, while the elimination of the phosphorus can be rapidly accomplished. All but one of the ten 50-ton basic open-hearth furnaces are of the rolling type, the stationary one being desirable from the fact that with a removable top it can be used for the melting of very large pieces, such as skulls, molds, rolls, etc., which have a relatively lower value as scrap in the open market.

The cost of making steel at Ensley by this combination is not known. The information would not necessarily be of great value in any event since it must be accepted, for the time being that there is no standard practice in the North to which to refer it. The cost of making steel depends largely upon the cost of the raw materials, and no one can now say, except for the briefest period what scrap is worth in the open market, relative to pig iron. Rarely in years past did heavy melting scrap approach the price of pig iron; of late it has reached that level, and in the very recent past it has averaged, for many delivered points, a measurably higher level. The old "talking point" of the scrap dealer, that heavy melting stock is worth 15 percent more than pig iron, may easily become a realized fact.

Ten years ago, when Alabama basic pig was found to be a convenience at Pittsburg for the utilization of Bessemer steel scrap, it could hardly have been predicted that ultimately the scene of its conversion into steel would be removed to Alabama, and that the scrap arising would itself be sold for use at Pittsburg. The vitality and flexibility of the process is established.

Some people who are prone to criticise have declared that the building of many libraries for all kinds of books is not an unqualified blessing, as it may encourage reading which does not strengthen the mind, but

certainly no one can question the wisdom of President Schiller of the National Tube Co. in presenting a considerable number of technical books to the public library at Lorain, O., for the use of employes at the great tube plant in that city. The absence of technical books and periodicals from offices of large manufacturing concerns and from the libraries of cities in which the plants are located is deeply to be regretted. President Schiller's policy of interesting employes in technical literature is capable of extensive development which promises rich returns.

AN HONORABLE CAREER.

The will of the late Wm. Sellers of Philadelphia disclosed an example of old-fashioned business integrity of a man unlike too many disciples of so-called high finance, who care nothing about their obligations to pay debts so long as they are able to live in dazzling luxury. Mr. Sellers began when a boy to earn his livelihood in a machine shop and by years of hard work amassed a large fortune. In the later years of his life, when he had passed the allotted three score and ten, he became interested in two large concerns, which involved heavy obligations. Perhaps he might have avoided payment, but he was not the kind of a man to seek a loophole to escape a moral obligation. He began to economize systematically and in his will he expressed the desire that the same plan be pursued after his death until the end should be accomplished. He went further and gave trustees under the will instructions that, after providing for the needs of the family, the debts must be paid gradually by the application of the balance of the annual income of the estate.

We are not of those who believe that all business virtue belongs to the past. On the contrary, we believe there is now more integrity in the world of trade than ever before, but dangerous tendencies, which are for the most part developments in modified form of old evils, are being given much prominence. Hence, to avoid drifting into pessimistic foreboding, it is well not to overlook the career of such a man as Wm. Sellers, which, not only in the one matter of debt referred to, but in countless acts extending over more than eighty years, is worthy of emulation.

Large orders for railway material and structural iron have been placed in Liege by firms in Argentina, according to a report by James C. McNally, United States consul at Liege, Belgium. They are divided among four of the principal mills and are being expedited as rapidly as possible. These, as well as other outside orders, have encouraged the manufacturers of steel and iron material to improve their works, and to replace old plants with modern, up-to-date machinery of extended capacity and capable of meeting demands for quick delivery. Two important steel works of Liege are at present working on an order of 6,800 tons of street rails for tramcars for English firms.

The Peterson Mfg. Co., Kent, O., manufacturer of pulverizers, will build additions in the spring, so that the capacity of the plant will be very largely increased.

ORDERS FOR LOCOMOTIVES.

An order for locomotives, amounting to $1,000,000 has, it is reported, been placed by the Kansas City, Mexico & Orient railroad. Delivery is to be made by Jan. 1, 1906. The company announces that by the time the engines are delivered the line between Kansas City and Sweetwater, Tex., a distance of 638 miles, will have been completed. The Bangor & Aroostook has ordered four 10-wheel simple engines and two simple 6-wheel switchers of the Manchester works of the American Locomotive Co., the former for delivery in May and the latter in February. The New York New Haven & Hartford has ordered forty simple mogul locomotives of the Schenectady works, and five simple switch engines of the Rhode Island works of the American Locomotive Co., and five simple 10-wheel passenger locomotives of the Baldwin Locomotive Works. This company has ordered forty-six locomotives of the Baldwin Locomotive Works. The Chicago Lake Shore & Eastern has ordered six consolidation locomotives of the American Locomotive Co. The Oliver Iron Mining Co. is having ten locomotives built by the Baldwin Locomotive Works and three by the American Locomotive Co. The Mexican Sugar Refining Co., Ltd., Tlacotalpan, Vera Cruz, Mex., is having two 25-ton locomotives with 10 x 16-in. cylinders built by the Glover Machine Works, Marietta, Ga.

The Baldwin Locomotive Works, Philadelphia, have received the major portion of an order for 152 locomotives for the Japanese Government. This is the largest purchase of locomotives ever made here by a foreign government. The Baldwin plant is to construct 77, the Atlantic Equipment Co. of New York 25, and a firm in Glasgow, Scotland, 50. The order was placed by Mitsui & Co., New York, agents of the Japanese Government, after bids had been invited from builders in this country and Europe. The terms of the contract require that the locomotives shall be built as soon as possible and delivered in lots of 12. They will be shipped by rail to the Pacific Coast, where they will be placed aboard steamships and sent direct to Korea. The order will necessitate an increased force of mechanics at the Baldwin works, though the force at the works now exceeds 14,000, including 3,000 men who work at night filling urgent orders. The first of the Japanese contract will be ready for shipment in 30 days and others will follow at intervals of less than a month.

Large orders for equipment of foreign roads have been received by the J. G. Brill Co., Philadelphia. The Zanzibar Railroad Co. has placed a contract with that firm for the construction of open horse cars, closed horse cars and flat passenger cars. A heavy order was received also from the Cape Government tramways of Cape Colony for patented semi-convertible cars, mounted on patented single trucks. Orders have been received also from the Compania Carris de Ferro Do Porto of Portugal, from the British Columbia Electric Railway Co., Vancouver, B. C., and from Bolivia.

Several more large orders for locomotives and equipment are in the market from foreign countries. Just what they are is carefully guarded by the holders until the contracts shall have been awarded. It is said that foreign orders were never before so numerous as this year.

The American Shipbuilding Co. has closed a contract with the Bessemer Dock & Navigation Co. for a twin screw carferry steamer to come out next October. The new boat in general character will resemble the Pere Marquette boats built by the American Shipbuilding Co. that are trading between Ludington and ports on the west shore of Lake Michigan. The boat will be operated between Conneaut and Rondeau, Port Dover and Port Stanley, on the Canadian shore. She will be 350 feet keel, 54 feet beam, 19½ feet deep to the car deck and 17⅓ feet to the shade deck. The cost will be $350,000.

The Labor Situation.

STRIKE AT GOSS PLANT ENDED.

A settlement of the strike of union machinists which has been in progress at the plant of the Goss Printing Press Co., Chicago, since May 24 last, has been effected. By the terms of the agreement 260 strikers will be reinstated as fast as vacancies occur, and a nine-hour working day will be maintained. The agreement signed will be in force until May 1, 1906. The strikers began to return to work Monday morning. An adjustment of the strike hinged on the maintenance of a nine-hour working day and the recognition of the union's classification of work for machinists. Both of these demands are provided for in the agreement. The wages are the same, the minimum being 30 cents per hour.

MILLS ARE CLOSED.

Alleged violations of the Amalgamated scale have resulted in the closing of the Crescent and Laughlin mills of the Whitaker-Glessner Co., the former at East Wheeling and the latter at Martins Ferry, O. At the Crescent mill black plate for tinning is rolled and at the Laughlin mill sheets are rolled. It is alleged that the men have been rolling light at the Laughlin sheet mill, that is, that they have been rolling 29 gauge sheets and have received credit for only 28 gauge. Whether the men did this willingly has not yet been ascertained, as both sides are uncommunicative. At the Crescent mill it is alleged that the limit of output has been exceeded and that the refusal of the men to continue this scale violation has resulted in the management closing the mill. That there are scale evasions in other sheet and tin plate mills is admitted by officials of the Amalgamated Association and it is doubtful whether anything will be done to correct the evil until the annual convention.

METAL TRADES ASSOCIATION NOTES.

E. P. Robinson, of the Atlantic Works, East Boston, Mass., chairman of the first district, which includes the States of Maine New Hampshire, Rhode Island and Massachusetts (East of Worcester County) has arranged the annual meeting of that district for 4 P. M., Wednesday, March 1, at the Trade Club, 77 Summer street, Boston, Mass.

J. Kirby Jr., of the Dayton Mfg. Co., Dayton, O., chairman of the eighth district, which includes Southern Ohio, has arranged the annual meeting of that district for 3 P. M., Wednesday, March 1, at the offices of the Dayton Employers' Association, Reibold building, Dayton.

A. W. Whitcomb, of the Whitcomb Mfg. Co., Worcester, Mass., chairman of the second district, which includes the States of Vemont, Western Massachusetts and Connecticut, has arranged for the annual meeting of that district for 2 P. M., Wednesday, March 8, at the Bay State House, Worcester, Mass.

L. H. Colburn, of the Colburn Machine Tool Co., Franklin, Pa., chairman of the sixth district, which includes Erie, Pa., Western Pennsylvania and West Virginia, has arranged for the annual meeting of that district for 2 P. M., Monday, March 6, at the offices of the Colburn Machine Tool Co., Franklin, Pa.

W. P. Cowles, vice president, The "Long Arm" System Co., of Cleveland, chairman of the ninth district (Northern Ohio), has arranged for the members of that district to take lunch with him at 1 P. M., Saturday, March 4, in the private dining room of the Chamber of Commerce Club, Chamber of Commerce building Cleveland.

The executive committee of the Boston Metal Trades Association has extended a most hearty welcome to the members of the first district to attend a meeting of the Boston Metal Trades Association and also a dinner.

The polishers in the employ of S. L. Allen & Co., Philadelphia, Pa., struck on Feb. 11, probably on account of an address in which the premium and piece work systems were condemned by the international president of the polishers' union, the night previous to the strike.

The annual dinner of the Philadelphia Metal Manufacturers' Association will be held at the Manufacturers' Club on Thursday, March 9.

The labor situation in St. Louis, Mo., is more quiet than for some time past.

J. W. Leigh, secretary of the St. Louis Metal Trades Association, holds the record for having secured more members for the National Metal Trades Association than any other of the secretaries of local metal trades associations.

LABOR NOTES.

There is now an unusual kind of labor trouble at Newport, Ky., and Cincinnati. Some members of the Molders' Union charge that former strikers, who purchased the Newport foundry and are now their own employers under the cooperative plan, are working for less than the union scale. Hence the foundries which have been forced to pay the higher rate of wages by the union have complained. A notice has been filed with the president of the National Molders' Union, Mr. Valentine, that if this alleged wrong is not righted, action will immediately be taken which may result in a lockout.

The differences between the New York, New Haven & Hartford Railroad Co. and the boiler makers and helpers in its employ have been adjusted, and the men have returned to work.

Colored men are taking the places of foreign laborers in the steel plants in and around South Chicago. Employers find that as they are able to understand instructions of their foremen more easily than the foreigners, they are not so likely to cause accidents.

A compromise has been effected between the foundrymen of Joplin, Webb City, Carterville, Carthage and Oronogo, Mo., and the striking molders. The strikers asked for a 9-hour day and compromised on 9½ hours.

Wages of the employes of the furnace operated by Corrigan, McKinney & Co. at Scottdale, Pa., have been increased 10 cents per day, effective March 1.

The Lookout Mountain Co., Battelle, Ala., has voted to issue 20-year 5 percent bonds to the amount of $400,000. Much of the sum thus accruing will be devoted to the improvement and extension of the present properties of the company.

Master sheet metal workers from various parts of the country as far west as Milwaukee met in Philadelphia Feb. 21 and formed the National Association of Sheet Metal Workers. Twenty states were represented.

The first order for a new boat for 1906 delivery was placed Feb. 21 when Capt. Charles H. Hutchinson closed a contract with the American Shipbuilding Co. for a 9,000-ton steamer. The new boat will be a duplicate of the two steamers building at the Bay City yard of the American Shipbuilding Co. for G. A. Tomlinson, of Duluth. She will be 524 ft. over all, 504 ft. keel, 54 ft. beam and 30 ft. deep. Work on the big freighter will not be started until next fall. She will be built at the Lorain yard.

The resignation of Charles Hudson as receiver of the Omega Steel Co., of New Haven, Conn., was presented in the Superior Court last week and was accepted. Attorney William L. Bennett, of this city, was appointed receiver.

The Marinette Iron Works, Marinette, Wis., has been purchased by O. W. Carpenter, of Menominee, A. C. Merryman of Marinette, and T. C. Miller, of Chicago.

PITTSBURG DISTRICT NEWS.

The Lawrenceville Bronze Co., Pittsburg, has called a meeting of its stockholders, to be held on March 20, to vote on a proposition to increase the stock from $25,000 to $75,000.

WiWllis L. King, vice president of the Jones & Laughlin Steel Co., Pittsburg, sustained a fractured leg on Tuesday evening, Feb. 14, while leaving his home to start on a trip to New York.

The Penn Bridge Co., Beaver Falls, Pa., has leased a plant at Carnegie, Pa., which it will operate until its present plant, recently destroyed by fire, is rebuilt.

The Meyersdale Sheet Steel Co., Meyersdale, Pa., will have its two mill sheet plant completed about April 1, and will roll black plate and planished steel sheets, gauges 18 to 30. A. F. Baumgarten & Bro., Pittsburg, will direct the sales and purchases of the plant.

The Charles G. Smith Co., Pittsburg, has been awarded the contract for the entire machine tool equipment for the large addition that is being erected to the plant of the Firth-Sterling Steel Co., Demmler, Pa. The equipment will consist of about fifteen Bullard lathes and turret machines and is one of the largest machine tool orders awarded in this district this year.

The Fawcus Machine Co., Pittsburg, will double the capacity of its plant by the addition of a second floor to its present shop The capacity of this plant was practically doubled in the past few years and owing to the great increase in the demand for the company's product and workmanship, this increase in capacity is made absolutely necessary.

It is probable that the Pittsburg plant of the American Steel Foundries will be abandoned owing to the expiration of the present lease, and the plant at Sharon, Pa., will be sufficiently enlarged to make up for the output that will be cut off by the baandonment of the Pittsburg plant.

The Carnegie Steel Co., Pittsburg, has awarded contracts for the erection of a water purifying plant at its Duquesne works. The plant will be similar to the plant erected by the National Tube Co. at McKeesport, and will overcome the many difficulties experienced due to the impure water secured from the Monongahela river. The plant will have an hourly capacity of 150,000 gallons. The purifying tank will be 57 ft. high and 49 ft. in diameter and will be built on the shore of the river. These storage tanks will be built for storing the purified water, each 46 ft. high and 45 ft. in diameter.

Mackintosh, Hemphill & Co., Pittsburg, has been awarded the contract for the construction of a 30 x 84-in. plate mill, together with a 44 x 60 Corliss engine to operate the same, by the Portsmouth Steel Co., Portsmouth, O. The mill is designed especially for rolling light plates and the housings will be of steel castings.

The Riter-Conley Mfg. Co., Pittsburg, now has under construction four of the large boring machines to be used in boring the Hudson and East River tunnels of the Pennsylvania Railroad. The boring machines are encased in steel cylinders made of riveted plates, of which there are three thicknesses, each half inch thick. They are 24 ft. in diameter and 16 ft. long. Within the cylinders are placed the boring edge of cast steel, the diaphragms, air locks and other apparatus and the cylinders move with the cutting edges. From the American Smelting & Refining Co., the Riter-Conley Mfg. Co. has received a contract for the erection of a steel building requiring 1,000 tons and which will be erected at Perth Amboy, N. J.

The Northern Engineering Works, of Detroit, have been awarded a contract for the electric traveling cranes required in the new plant of the Detroit Steel Casting Co. There will be one 30 ton, 4 motor crane, and two 10 ton, three motor cranes, all 70 ft. span. They have also secured contract for one 3 motor, 5 ton special electric traveling crane from the Michigan Malleable Iron Co.

LAKE SUPERIOR IRON MINES.

An extensive drilling contract has been taken in the vicinity of the Princeton mine, Swanzey, Cascade range, and will have two or more machines at work at once. It is not announced for whom this work is to be done, but it is supposed to be either the Cleveland Cliffs Iron Co. or the Oliver company. The former company has been doing a lot of work in this vicinity for some time, and is putting up buildings at Swanzey.

Old Ottawa mine, near Hurley, on the Wisconsin end of the Gogebic range, is being unwatered and mining commences there in about a month. Supt. G. H. Abeel, of the Montreal, is in charge. The mine has been a small producer and is not very extensively developed underground. It has been idle most of the time for the past ten years.

A few men are employed at the old Kloman mine, Marquette range, preparing for the resumption of explorations there. The old pits and the two shafts will have to be pumped out, but that is a small task, as the workings are not extensive.

The Oliver Iron Mining Co. has shipped some grading outfit to the Stephens mine and will probably mine heavily there this year. The mine sent out a little ore two years ago, but has never been really a shipper on the scale that is possible. It is a very large mine, and is developed for steam shovel mining on a large scale. It is the most easterly of all large Mesabi mines. The Duluth & Iron Range will double track its line between Wyman and Colby, which is the only remaining link in the double tracking of the entire line from the docks to its Mesabi termini.

Both the Lake Superior and Ishpeming and the Duluth, South Shore & Atlantic, with ore shipping docks at Marquette, are now at work overhauling them and making the needed repairs for a large season's business. The two roads last year shipped about 1,000,000 tons each, as an average, and expect to increase this materially this season. Work on the new dock of the Chicago & Northwestern, at Ashland, is said to be moving along fast enough so that it will be in shape at the opening of navigation, which is looked upon as early. The docks of the Duluth & Iron Range and the Duluth, Missabe & Northern, which are being respectively rebuilt and extended, are well along and the former will be ready in April.

With a contract given a few days ago the Great Northern road will have double tracks between its mine assembling yards on the western Mesabi range, and its terminal yards near its ore shipping docks. These two tracks do not run beside each other most of the way, for light trains, run by way of Swan river and Hibbing, while the loaded trains come south via Stoney Brook junction.

It will be the middle of April before the Carp charcoal furnace at Marquette, Lake Superior, resumes. A new and larger blowing engine is being put in and other improvements are under way. The kilns will be fired in about two weeks, in order that there may be ample supply of fuel when the furnace blows in.

Pickands, Mather & Co. have taken a lease of the Young farm, in Stambaugh township, Menominee range, and an 80-acre tract will be developed. The royalty to be paid is 15 cents a ton for Bessemer and 10 cents for non-Bessemer. The property adjoins the company's Baltic mine on the north, and was explored some months ago by this firm. At that time nothing was found, but later mining at the Baltic shows that the Baltic vein dips into the Young property. The same firm's Troy mine at Eveleth, Mesabi range, is to be reopened, after having been closed since May 1. This firm has exercised its option for the northeast quarter of the southwest quarter of section 4, town 58, range 15, on the Mesabi range. A company to be known as the Mohawk Mining Co. has been organized to handle the property.

At Holland mine, Biwabik, they expect to resume work soon. The mine has made sales of all ore it will probably get out this year, some 200,000 tons, and will be an early shipper. A good deal of its ore will go to the Sault for the Algoma Steel Co.

BRITISH NOTES.

Douglass Francis and Charles Whittington, iron founders and stove and grate merchants, of the Central Iron Works, Leicester, trading as Francis & Whittington, have dissolved partnership.

The Sinclair Iron Co., Ltd., has acquired fourteen acres for the erection of its new works at Ketley, near Wellington. The site is close to the Great Western Railway, from whose system a siding will enter the proposed works.

John Shaw & Sons, Wolverhampton, Ltd., of Wolverhampton, have appointed Harry Chilton as their representative in the West of England.

The Union Electric Co., Ltd., of 151 Queen Victoria street, London, E. C., has opened an office at 43 Grainger street, Newcastle-on-Tyne, under the direction of James Gilman.

Edward Lomer, of 12 St. Mary Axe, London, E. C., has been appointed sole agent for the United Kingdom for the Schwarzblech Vereinigung, of Cologne (the German Steel Sheet Union).

Councillor John Dick, manager of William Jacks & Co.'s Grangemouth branch, has received the appointment of manager to the Skinningrove Iron Co., which contemplates opening a place of business at Grangemouth.

W. S. Malcolm, manager of the foundry department at Carron Iron Works, was entertained a few days ago by the members of the Falkirk and District Ironfounders' Association on the occasion of his leaving to become works manager of the Coalbrookdale Co., of Coalbrookdale. W. J. Gibson, of the Saltoun Iron Co., president of the association, occupied the chair, and T. W. Alsop, general manager of the Falkirk Iron Co., officiated as croupier. Mr. Malcolm was presented an oak writing desk and chair.

C. H. Pearson, of the London office of the Blaenavon Co., Ltd., has been appointed rail representative in the metropolis for the Barrow Hematite Co., in succession to the late J. J. Wallis.

J. T. Dobb & Son, of Sheffield, who supply a large proportion of the alloys used in the local steel trade, has purchased what are described as valuable wolfram properties in Portugal, from which they intend to recover tungsten.

The Falkirk Iron Co., of Falkirk, has lately completed an important extension of its enamelling works, which enables them to turn out 700 baths weekly.

The death occurred on February 6 at Frank Parkin, senior member of the firm of Parkin & Sons, ironfounders, of Exeter. The deceased, who was seventy-six years old, was a man of robust character, and wielded a strong influence in parochial affairs, in which he used to take a prominent interest.

James Shepherd, founder of the engineering works of the Power Pulley Co., of Princess street, Manchester and Levenshulme died recently. The deceased, who had carried out extensive orders for heavy gearing and millwright work for the admiralty, war office, and many foreign governments, was also associated with the Wedge Tyre Co., and was a vice president of the Manchester Institute of Mechanical Engineers. He was seventy years of age.

The output of iron ore from the mines of the Marbella Iron Co., Ltd., during January amounted to 3,330 tons.

Thomas C. Hutchinson, of the Skinningrove Iron Works, has been elected president of the Cleveland Ironmasters' Association.

The new works of the Avonside Engine Co., of Bristol, are now practically completed and the whole of the business will be conducted from these works from Feb. 27.

Brownlie & Murray, Ltd., of Glasgow, have lately received some important contracts for shipment abroad, notable among these being the steel structural work for a 480 ft. span suspension bridge, buildings for two large engineering shops, Chinese and Kaffir bunks, and over 100 tons of tie-rods for jute mill construction.

A disastrous fire broke out at the Eglinton Iron Works, Kilwinning, Scotland, recently, resulting in damage to the extent of about £5,000. The fire originated in a blast engine house, which was completely gutted, and the two sets of powerful engines were damaged. It will be necessary to close the furnaces for some time.

The big mill at the South Durham Iron & Steel Co.'s Moor Works, Stockton, was restarted on Thursday of last week, after more than two years' idleness. Upwards of 300 extra hands were obtained, and the plant, which during the past few weeks has been greatly improved, worked very smoothly producing steel plates.

The business of the Masborough Foundry Co., of Rotherham, has been acquired by the Wigston Foundry Co., of Leicester, whither it is to be transferred.

In South Wales and Monmouthshire there is a general consensus of opinion that the tin plate trade in 1904 was more prosperous than in any period since the passage of the McKinley bill. Some 400 mills are in operation, or 50 more than in 1903, and this number will probably be increased in the near future. The renewal of the twelve months' wage agreement in July had a steadying effect on the trade, and as Russia, Japan and China came into the market for large supplies of tin plate for canning purposes, prices began to advance gradually. The steel trade has, of course, shared considerably in the prosperity of the tin plate makers during the last three months. In the earlier part of the year, owing to the importation of tens of thousands of tons of steel bars from abroad, half of the smelting furnaces were idle.

Eastern Pennsylvania.

HARRISBURG, Pa., Feb. 21.—Mills and furnaces in this part of the Keystone state are being started up for a busy spring and from all accounts there are many inquiries at offices of works for estimates on contracts. The big companies are booking considerable work in rails, plates and similar material and the rolls of the paymasters are climbing up.

In addition to the large orders placed by the Pennsylvania, Baltimore & Ohio and other companies to concerns in this state, there are prospects of considerable foreign work, chiefly for Asia. The Japanese government locomotive orders have caused activity among several works in this part of the state which supply the Baldwin works with material and there are rush orders being filled.

Furnace activity is noticeable. At Lebanon the Lackawanna company is preparing to start its group and two stacks will start very soon. One at Sheridan will be blown in as soon as possible and Robesonia will start when repairs are complete. In the Lower Susquehanna valley, the Susquehanna Iron & Steel Co. will start furnaces when ready, two being available. There may be another furnace started in Lancaster county. In the Schuylkill valley one of the Brooke furnaces will go in. Others in that locality are making large products, Warwick No. 2 having made 3,250 tons in one week.

The Greer-Clarkson Co.'s machine shops at Manheim, sold by trustee recently, will be operated.

Portsmouth Steel Co.'s Additions.

The Portsmouth Steel Co., whose works are at Portsmouth, O., and general offices at Wheeling, W. Va., has decided on an expenditure of about $300,000 in remodeling its present plate mills, and installing a new three-high 30 x 84-inch plate or jobbing mill. These improvements will double the capacity of the plant.

The Standard Sanitary Mfg. Co., Beaver Falls, Pa., has purchased a building and will convert it into a foundry. The company expects to have it in operation within 30 days.

THE MANUFACTURE OF CAR WHEELS.

To the Editor:

Referring to Mr. G. K. Hooper's article in your issue of Feb. 9, criticising methods employed in my continuous car wheel molding process, described in your issue of Feb. 2, the author shows a lack of knowledge of the subject in hand, that is, the making of cast iron car wheels.

In one portion of the criticism Mr. Hooper figures that the time of cooling flasks is twenty-five percent of one hour and forty-five minutes and his idea is to use a separate conveyor to handle the flask for twenty-six minutes while cooling and thereby make a smaller conveyor for molding, pouring and stripping, and this smaller conveyor, he states, would make a saving in flask equipment. As a matter of fact, the size or number of conveyors has no relation to the flask equipment necessary, as this is based wholly on the speed of melting and the time necessary to cool the car wheel equipment, which is upwards of five hours rather than twenty-six minutes, as stated. Mr. Hooper's suggestion for a smaller conveyor stands alone, as all experienced car wheel men who have seen the conveyor working suggested a larger rather than a smaller one, as there is no spare room on the conveyor at the present time.

Every operation and the time allowed between the operations in my process is based on the speed of melting and we figure to do things at the proper time and at their respective places; however, all operations requiring mechanical movement are flexible. Mr. Hooper's statement to the contrary, notwithstanding, and a stoppage of any mechanical appliance used for from fifteen to thirty minutes, does not interfere with the speed of melting. All this is shown in the article published, with the possible exception of the roll-over hoist at the molding section and in the installation this hoist is hung on a trolley. I wish to uphold the statement that this system is the only one, to the best of our knowledge and belief (and we Pittsburgers occasionally get into the glare of the electric lights on Broadway), that combines molding, pouring and stripping *on the conveyor*. We know of several processes where flasks are removed for molding, replaced for pouring and again removed for stripping and again replaced on the conveyor for movement to the molding section. This amount of handling usually interferes with the efficiency of the so-called continuous process and my patents cover these points of the system very clearly.

From the criticisms offered, I judge Mr. Hooper's experience in continuous foundry practices has been limited to light work and comparatively thin sections. It is difficult to conceive of a loose jointed conveying system such as suggested for the making of car wheels as the flasks weigh about 1,500 lb. light and 2,600 lb. when containing sand and casting, and further, it is quite impossible to make car wheels under light casting foundry practices and certain operations in car wheel making do not permit of the scope of operation which Mr. Hooper thinks necessary. He speaks of the system he has in mind doing certain things. It would be interesting to see his ideas on paper, as they usually look somewhat different in that form. The number of operators actually used in making wheels is twenty-eight, as shown in the table; additional men were shown to enable wheel makers to readily make a comparison of costs with old practices and with more cupola melting capacity and a larger sand conveyor, the installation used at the present time is capable of producing one wheel per minute, or sixty wheels per hour during a 10-hour day with about eight additional men. A production of forty-eight wheels per hour has been maintained for several hours by using surplus sand, as th sand conveyor in use has not sufficient capacity for this number of wheels. This makes seventeen wheels per man in place of ten, as our critic makes it appear. The criticism on sand handling is also uncalled for, as the reason for using the reciprocating conveyor more than offsets the objections mentioned and this system was adopted after investigating the best practices in sand conveying and upon the recommendation of expert conveying engineers. The amount of sand used in making a car wheel is approximately 420 lb. or 60 percent of the weight of the casting. About 25 percent of this sand is delivered to the conveyor in any part of the space 40 ft. long at a temperature of 1,100 or 1,200 deg Fahr., which means that it is red hot and the temperature of the balance of the sand varies from this down to steaming hot. When this sand is delivered to the molding section or reserved stock pile it must be cooled and tempered ready for use, otherwise it would dry out on the surface or retain heat deep down in the stock pile, and be unfit for use. This work must be accomplished in a comparatively short space of time and we feel that the reciprocating conveyor which cuts the sand many times during its short travel answers the purpose better than any system of mixers we could install. Sufficient sand is carried to operate about one hour in case of stoppage of sand conveyor, overflows being provided at convenient places near the cope and drag molding section. When the sand conveyor is out of service stripping is done under the circular cranes and this system can be continued indefinitely by using about six laborers to get the sand around to the molding sections. The sand is handled by two 15-h. p. motors and the amount of fuel used in supplying power to these motors cost a small fraction of a cent for each wheel made.

Car wheel molds can be shaken down with very much less effort than is suggested by Mr. Hooper and this experiment must have been on molds with a perfect arch in the cope.

The average weight shown can no doubt be reduced in certain localities, but is none too high for the Pittsburg district, where it is necessary to pay a little bonus for good men as common labor is paid $1.75 per day in many establishments. However, an intelligent laborer can be taught any one job on the rig in a few hours.

C. W. Sherman.

Pittsburg, Feb. 14, 1905.

To the Editor:

Replying to Mr. Sherman's favor of Feb. 14 concerning my criticism of his car wheel making system, I would say that he apparently misreads much that I have said.

In the first place, I have not said that the time of cooling the flasks is 25 percent of one and three-quarter hours, but I did say, and his illustrations show it to be a fact, that if the whole circuit of his apparatus is completed in one and three-quarter hours, the cooling of the casting takes place over but twenty-five percent of that time. I cannot find that I have said anything in my communication about a "smaller" conveyor. I spoke of a "separate" one, and can hardly be charged with having in mind one too small for the work.

Mr. Sherman's statement concerning molding, pouring and stripping on the conveyor differs from the statements which I criticised in the published article which said that "outside the car wheel line no attempt has been made at operating continuously, with a process that combines molding, casting and stripping." I am willing to grant that the statement in his letter of the fourteenth is true, giving with it my opinion that much better results are obtainable with other types than that illustrated.

I cannot grasp the idea contained in his remark concerning the weight of flasks full and empty in a "loose-jointed" system, such as he describes my suggestion to be, since the same lifting and handling appliances as he uses would probably work just as well for me, wherever I want to handle a mold, as they do for him. With reference to my putting my suggestions on paper, would say that I would do so gladly for Mr. Sherman at any time that he will drop into my office.

Mr. Sherman again makes a different statement from that in the published article, where he says that the number of

operatives actually used in making wheels is twenty-eight. The article distinctly says that "the above number of men will produce 350 good wheels in ten hours," and thirty-five men are distinctly included in his table. I did not in my comments refer to the fact that Mr. Sherman's table contains no mention of the amount of power house and electrician's labor necessary for furnishing power to his apparatus, nor the stockyard and charging platform labor used in handling the amount of material melted for such a production as he names. He may have included all of this, but I doubt it, as there does not seem to be enough cupola labor included to handle the amount of material necessary to make 350 wheels in ten hours. Nor does he make any mention of superintendence. If this additional labor be included, it will be found that his figures for output per man will drop below their present level. If he wishes to include only what labor is included in his summary of twenty-eight men, I will raise my estimate of production per man to about twenty-five wheels per ten-hour day.

Mr. Sherman's further remarks concerning his sand handling apparatus only confirm my expressed opinion. My ideas concerning the proper construction of such apparatus are based on one which I operated, it handling about 500 tons of sand per ten-hour day, while Mr. Sherman's handles, according to his own figures, but about 100 tons, where making forty-eight molds per hour at 420 lb. per mold. This 500 tons per ten-hour day was dumped red hot from the molds and was riddled, tempered and cooled, and back in the hoppers ready to go into another mold in something less than three minutes, in my apparatus, so he must acknowledge that my ideas in this matter are founded on experience. I think a reserve stock pile entirely unnecessary, if I understand it correctly, and but one overflow is necessary instead of several, this hardly being an overflow, "short circuit" being probably the more truthful term. The "overflow" is one of the worst features of the reciprocating conveyor, and in my opinion condemns it.

Generally—The lack of flexibility, of which I spoke, is again brought out by Mr. Sherman's remark concerning the speed of melting, as a basis. I think that the most efficient continuous system is that based on the time necessary to perform the longest operation in making the mold, the melting equipment being sufficient to pour the molds thus made. By thus designing the system, full advantage may be taken of every improvement in the art.

G. K. Hooper.

New York, Feb. 17, 1905.

A Detroit Consolidation.

The consolidation of the Detroit Foundry & Mfg. Co. and the Detroit Automatic Stoker Co., both of Detroit, has been effected, the consolidation taking the form of a change in name of the Detroit Foundry & Mfg. Co. to the Detroit Stoker & Foundry Co., and increasing the capital stock from $75,000 to $110,000. The reason for this consolidation was a natural one, for the purpose of reducing expenses and giving better opportunities for pushing the sale of the Detroit automatic stoker. The Detroit Automatic Stoker Co. was located in a building adjoining and belonging to the foundry company and some of its stockholders were interested in both concerns. The officers of the Detroit Stoker & Foundry Co. remain the same as they were in the Detroit Foundry & Mfg. Co., namely: President, F. L. Bromley; vice president, J. W. Thompson; secretary and treasurer, C. F. Lawson. It is not expected that there will be any additions made to the plant, as at the present time there is ample room to take care of all business which may be obtained. Prospects for the coming year are very good, especially in the stoker field, as the Detroit automatic stoker is being well received wherever it has been installed. This business is growing very rapidly and the indications are that the output will be double in 1905 that of 1904.

PERSONAL.

Some change in the management of sales offices of the Carnegie Steel Co. will soon be effective. James R. Mills Jr., manager of sales at Cleveland, will be succeeded by John R. Scott, heretofore in charge of sales at New Orleans. Mr. Mills will go to the St. Louis office of the company. W. G. Clyde, assistant manager of sales at Cleveland, will go to the Pittsburg office as assistant general manager of sales. He will be succeeded at Cleveland by B. F. Harper, who has been special sales agent in central territoty. Under the management of Mr. Miils the Cleveland office of the Carnegie Steel Co. has become one of the most important in the country, and the strong personnel of the Cleveland office has been a prime factor in the record that has been made.

Walter Fairchild has been placed in charge of the New York office of the National Electric Co., 135 Broadway, New York. Mr. Fairchild formerly represented the Bullock Electric Mfg. Co. in that city, and prior to that represented the Stanley Electric Co. in New York. Robert S. Hopkins has been appointed city sales agent, with headquarters 135 Broadway, New York. Mr. Hopkins obtained his engineering experience with the Bullock Electric Mfg. Co. J. Frank Perry has just been appointed sales engineer. He is at present in California representing the interests of the company.

Frederick W. Sivyer, president of the Northwestern Malleable Iron Co., has been re-elected president of the Milwaukee Merchant and Manufacturers' Association. Mr. Sivyer has been very active in endeavoring to establish a trade school in Milwaukee, and a committee from the association is raising funds for the school.

Frank S. Whitelaw, for some time assistant manager of the Michigan branch of the American Radiator Co., has been promoted by the company to the position of manager of the Bond plant at Buffalo.

H. J. Stambaugh, of the Falls Rivet & Machine Co., Cuyahoga Falls, O., has resigned his present position to become the secretary and treasurer of the Wm. Tod Co., Youngstown, O.

Duncan Sinclair, who has been associated with the management of the Coalbrookdale Iron Works, has recently undertaken the managing directorship of the Sinclair Iron Co., Ltd., of Wellington, Shropshire, England. Mr. Sinclair visited this country some years ago and will be remembered by many who had the pleasure of forming his acquaintance.

S. H. Moore, who has been connected with the Bourne-Fuller Co., Cleveland, will go, on March 1, with the Bodifield Belting Co., of that city, as treasurer and manager of sales.

Sherman Jones, one of the open-hearth superintendents of the Homestead works of the Carnegie Steel Co., Pittsburg, has been appointed superintendent of the LaBelle open-hearth plant, Steubenville, O.

Paul Jones, treasurer of the Wm. Tod Co., Youngstown, O., for a period of 27 years, has retired and has been succeeded by Harry Stambaugh.

Chas. W. Cross, M. E., E. E., formerly of the Roberts & Abbott Co., consulting engineers of Cleveland, and later electrical engineer for the Eastern Ohio Traction Co., has entered the employ of the Crocker-Wheeler Co., of Ampere, N. J., and is attached to the Cleveland office at 816 New England building

Edward Worcester Jr., of the Chicago office of the National Tube Co., has been transferred to the office of one of the constituent companies of this corporation. He is succeeded by H. E. Williams, formerly of the McKeesport mill of the National Tube Co.

David O Holbrook, who has been vice president of the Pennsylvania Malleable Co. and Central Car Wheel Co., has resigned to accept the office of vice president of the Dayton Pipe Coupling Co., and will open an office in the Park building, Pittsburg.

Fundamental Principles in Blast Furnace Practice.*

BY EDWARD A. UEHLING.

The ore should be of uniform quality, or a uniform mixture of ores of dissimilar qualities, chemically adapted, to yield collectively the iron desired, and to produce with the flux available that quantity and composition of slag best adapted to fulfill its proper functions in the process of smelting. Neither a very lean ore, or ore mixture, nor yet ores that are exceedingly rich in iron, are conducive to obtaining the best results, but a regular mixture of low grade ores will yield better results than an irregular mixture of much higher average grade, certainly as to quality and generally also as to quantity of output. In regard to a few of the chemical elements the ore must be, and always is, selected and mixed to produce the desired iron; but in regard to the physical condition there is at best but a limited choice and frequently none whatever. It may be laid down as an axiom, that the more refractory an ore is, the finer it should be physically to become readily reduced. In the storeroom of nature we find, however, that the more refractory ores occur generally in compact masses, while those easily reducible are most frequently found in a more or less finely comminuted state. The logical corollary to the above axiom, viz., that the finer the comminution of an ore the greater its reducibility, and hence the more readily it can be smelted, while theoretically correct, does not hold good in the blast furnace, and especially not in the modern blast furnace. Two reasons why this should be so present themselves very readily; first, the finer the ore the greater must be the resistance offered to the ascending gases, and, second, the greater must also be the quantity of ore dust carried over into the gas flues. These difficulties give rise to others which with certain ores have frequently proven serious.

In smelting very fine ores the increased blast pressure was the objection that made itself felt first, and in the measure as this was being overcome by stronger blowing engines, the loss in flue dust was increased. No serious difficulties were encountered, however, until after the advent of the ores from the Mesabi range. These ores, while unsurpassed in chemical compositions, ease of reduction, and cheapness of getting, possess physical properties which illy adapt them for conversion into pig iron in the monstrous blast furnaces in which they are being smelted. In the majority of the deposits the very fine ore preponderates, in some cases as high as 20 percent, will pass through an 80-mesh sieve. Much of this ore is carried over with the gases. The average loss of Mesabi ore in flue dust is between 3 and 5 percent, and the greater loss is not uncommon.

Preparation of Ores.

Although much advance has been made in the past decade in the way of preparing the harder varieties of ore by crushing them, generally at the mines, which is the proper place, instead of depending on a few men in the stock-house to break up the largest lumps with sledge hammers; yet, little or no attention has been given to the actual requirements. All hard ores are crushed to a given size, irrespective of their reducibility. Hematite ores generally go into the furnace in a finer state of comminution than magnetites, when because of their great reductibility the reverse should be the case. It is the author's opinion that all hard ores could bear much finer crushing than is at present customary, and that this would be conducive to fuel economy particularly with the magnetites. The latter could be crushed with advantage so as to pass through a 2-in. round-holed screen, and even smaller.

The importance of sizing or separating ores with regard to their relative coarseness or fineness has as yet received but little attention in American blast furnace practice. I dare say the majority of furnace managers have not given this phase of the subject the thought and careful study it deserves. Every furnace man objects to either very fine or very coarse ores, and all would, no doubt, prefer a uniform and relatively coarse ore, but since it is quite the exception that uniformly coarse ores can be supplied, they must be taken as they come, and the general practice is to charge the coarse and fine ores indiscriminately as they happen to be at hand, or at best attempt to mix them as much as possible. The former method is bound to produce more or less serious disturbance in the working of the furnace; not only because of the physical irregularity, but also because the fineness of a given ore may vary very considerably in composition from the coarser portions. The uniform mixing of the coarse and fine ores, though much better chemically, at least, is, nevertheless, far from being the best method of charging. The worst possible ore mixture, from a physical point of view, is that in which the coarse and fine are so proportioned and so thoroughly mixed that the latter fills all the interstices between the lumps of the former. A layer of such a mixture is less penetrable, offers greater resistance to the ascending gases, hence requires a higher blue pressure and is apt to produce more flue dust, and is therefore less desirable than if it consisted of fine ore alone. This is true to a greater or lesser extent of all mixtures of irregular sizes, and the greater the difference between the coarse and the fine, the worse. To be right, ores should be separated into three, or preferably into four sizes, viz., coarse, medium, fine, and dust. All ore passing over, say, 1½-in. mesh screen to be classed as coarse; through 1½-in. and over ½ in. to be classed as medium; through ½ in. and over 1-20-in. mesh to be classed as fine, and all that passes through 1-20-in. mesh to be classed as dust. The latter should either be briquetted or agglutinated in some satisfactory manner or else smelted in a furnace by itself, designed and equipped for the purpose, preferably in a low, wide furnace, blown with a mild blast through tuyeres of variable penetration, or perhaps electrically. The coarse, medium and fine ores could be smelted together in the same furnace with a strong blast. To do so to the best advantage they should be charged in separate strata. The above scheme, i e, to first separate the ore into several sizes and then fill them separately, will, no doubt, be objected to as impracticable, as an expensive and useless complication, or at best a refinement of doubtful utility. Whether such objections are all, or only partly, or not at all true, depends on our viewpoint. If we should attempt it with the present equipments, even the most modern, it would probably be impracticable; if we feel that we have reached the acme of perfection in blast furnace practice, it must seem a useless complication, and if the present output is qualitatively as well as quantitatively fully satisfactory, the sizing of the ores would certainly be of doubtful utility. If, however, we wish to combine uniform quality with maximum output and greatest fuel economy, we must seek to eliminate all disturbing factors, and the physical irregularity of the raw material certainly is one of them.

Roasting the ores is resorted to generally only for the purpose of eliminating such deleterious constituents from the ore as can be driven off by heat. The process is always carried on in an oxidizing atmosphere. In this country the roasting of ores is rarely resorted to, except for the purpose of eliminating sulphur. All magnetic ores are improved by roasting, and the question whether it would pay or not to do so depends entirely on local conditions; first, on the cost of coke or other furnace fuel, and, second, on the market value of electric current. The same is true with other varieties of ores; for example, the hard red ores of the Birmingham district, which could be greatly improved by roasting.

*From the *Journal* of the Franklin Institute. Mr. Uehling is a consulting engineer at 135 Broadway, New York.

Briquetting, Agglutinizing, Cindering, Electric and Chemical Treatment—all these relate to putting ore dust into some form that will overcome objectionable qualities. Much time, ingenuity and money have been expended in this direction, resulting mostly in failure or at best in indifferent success. This, however, does not imply that the problem cannot be solved, or even that it may not have been solved already by some method awaiting practical demonstration and commercial development.

Theoretically, the finer the ore, the more economically it should be smelted. To the practical objections against the use of very fine ores, viz., heavy blast pressure and reduced yield, etc., should be added the difficulty encountered in properly distributing the fine ores over the coke charge. The latter problem fully solved, the author is of the opinion that the very fine ores could be smelted to best advantage by themselves in a specially designed blast furnace. Smelting in an electrical furnace possesses possibilities of success which depend chiefly on the cost of power, and with the proper utilization of the blast furnace gas its practicability as an adjunct to the blast furnace becomes very much less doubtful, and may prove profitable under certain local conditions.

Flux, Slag, and Fuel.

Flux.—Under the general term of flux, we understand that addition to the material smelted, which will chemically combine with the gang and other impurities of both ore and fuel and produce a liquid slag. With very few exceptions the acid elements contained in the gang largely predominate. For this reason, the flux must nearly always be basic, and because of its abundance and cheapness, limestone is almost invariably used. Should, however, the basic element in the ores predominate, an acid flux would have to be added, and quartz rock or highly silicious iron ore take place of limestone. What has been said of the preparation of ores holds good in a general way also for the preparation of the flux. It should be well broken, and as much as possible of uniform size; dust should be entirely avoided. Theoretically, it would be of considerable advantage to calcine the limestone or dolomite before filling into the furnace. There are, however, practical difficulties due to the fact that unless the stone is very hard burned, it readily becomes air-slaked, and is then worthless, since it is too largely carried over by the blast. Attempts that have been made to drive off the carbonic acid before filling into the furnace have generally failed on that account.

Slag.—The function of the flux is to fuse with earthy impurities of the ores and fuel and melt into a liquid slag. The function of the slag is two-fold—physical and chemical. Physically it acts first as a filter, purifying the globules of reduced iron as they pass through, and, second, as a blanket protecting the metal against possible oxidation by the blast. Chemically its most important functions are to absorb and carry off sulphus, and to assist in regulating the silicon content in the iron. Magnesia is a stronger flux than lime in ratio of their respective atomic weights, and with an ore mixture comparatively free from sulphur smelted with a low sulphur fuel, dolomite is proportionately more efficient than carbonate of lime; but since sulphur exists in the slag only in combination with calcium, thte latter element must predominate where considerable quantities of sulphur are to be removed.

The proper composition of the slag is of greatest importance, and in selecting ores and fuel, due consideration should be given to the composition of the gang and ash respectively. Alumina should be kept as low as possible. Although this element does not materially reduce the fusibility, it does largely reduce the fluidity of the slag, and fluidity is of the most vital importance in a blast furnace slag. So far as the author's experience goes, the lower the alumina can be kept the better; and if a slag results from the regular mixture containing over 15 percent of alumina, silicon material should be added to the burden. A slag to be most efficient should melt like ice; that is to say, it should retain a solid form until it melts, and as soon as melted it should be quite liquid, instead of gradually passing from the solid to the liquid state. The latter property causes sticking and hanging, and on account of the sluggishness of such a slag, it cannot fulfil its functions properly. It has a tendency to retain the finer globules of iron, thus causing material loss. Generally the ores contain ample earthy impurities so that with the addition of flux necessary to form a desirable slag, the proper quantity is also produced. In many instances it has proved good practice to add silicious material for the purpose of improving the quality of the slag as well as of increasing the quantity.

Fuel.—The fuel for the blast furnace may be raw coal, charcoal, anthracite, or coke. The first of these has entirely ceased to be a factor in the production of pig iron in this country. The percentage of charcoal used is becoming less and less as timber becomes scarcer and dearer. The same holds true for anthracite coal, because of its limited supply, and although still used in considerable quantities it is bound to be practically replaced by coke in the not distant future. Coke, besides its practically unlimited supply, possesses all the essential qualities of a superior blast furnace fuel.

The fuel performs two functions in the blast furnace—physical and chemical. The physical function of the fuel consists in preserving a comparatively open stratification in the descending column of stock in the furnace, thereby permitting an easy upward flow of the ascending gases. To fulfil this function properly the fuel should be coarse and rough, and as uniform as possible in size. Very large lumps are as undesirable as fines. It should be of sufficient strength to reach the tuyeres with the east loss by abrasion. Fuel dust, or breeze, should never be charged into a blast furnace; the most of it is directly blown over with the gas, and what little is retained in the furnace is apt to do more harm than good.

The chemical functions of a blast furnace fuel are twofold. (1) To generate by semi-combustion with the oxygen of the blast, all the heat necessary for the process of smelting, and (2) to produce the reducing gas necessary to convert the ore to the metallic state. It should possess the greatest possible cell development consistent with the required physical strength, so as to offer the maximum surface to the oxygen of the blast, and yet possess such chemical stability that it is but slightly affected by the oxidizing action of the CO_2 in the upper zones of the furnace. To possess these properties the first requisite is that the coke is well burned and made from coal which will produce the proper cell structure and necessary strength.

The most objectionable element contained in coke is sulphur. Phosphorus is of importance only when special irons are being manufactured. The composition of the ash is of as much importance as the quantity. The alumina should be as low and the silicon as high as possible. This holds true especially where foundry iron is smelted. Iron is a valuable constituent, and is often contained in sufficient quantity to add appreciably to the yield of the ore. The author is of the belief that most of the silicon in the iron produced comes from the ash of the coke; and if the ash, therefore, is of the proper composition it may add materially to the ease of producing high silicon iron.

The Blast.

Air.—The largest, the cheapest, and the most neglected constituent of the raw materials involved in the process of smelting is the air which furnishes the oxygen required to burn the fuel and produce the heat and chemical reactions. Strictly speaking, the blast is furnished to every furnace variable in quantity, irregular in temperature, and, worst of all, variably contaminated by moisture, and because of these, as much as other irregularities, also at variable pressures.

It is probably quite within the memory of most of the older furnace men, if not within their own experience, that it was the general practice to regulate the blast by pressure. In England, where they still blow several furnaces (as many as six or more) off the same blast main, this practice of necessity prevails. In this country blowing by volume is the rule. The blowing engines are ordered to be run steadily at the required revolutions; but variable steam pressure is a disturbing factor, variable blast pressure is another. Then again constant revolutions, i. e., constant volume by engine measurement does not insure a constant quantity of blast delivered into the furnace. Innumerable, avoidable and unavoidable leaks, between piston and tuyeres, engine-room temperature, and the barometric pressure of the atmosphere, affect the quantity delivered. The latter alone may affect the quantity delivered from 6 to 10 percent, and loss through leakage from 10 to 15 percent and more is not uncommon.

The author believes himself to have been among the first to blow a furnace by constant volume. The change from pressure to volume blowing at once brought a noticeable improvement in the regularity of the output, but the number of charges taken by the furnace did not agree as closely as they should with the regular quantity of wind supposed to be delivered by the blowing engines. Revolution counters were attached to the engines, and the fact was at once revealed that the revolutions marked had not been regularly blown. Getting the engineers interested resulted in a friendly rivaly to blow the exact number of revolutions. For longer or shorter intervals the fuel charges would agree with the revolutions, then again there would be puzzling discrepancies that could not be explained by irregularities in the working of the furnace. Barometer and thermometer observations finally practically cleared away all otherwise unaccountable discrepancies, except that the calculations showed the quantity of air delivered by the blowing engine to be far in excess of that required to burn the fuel consumed. The numerous small leaks, which had not been considered of much importance prior to accurate determination of wind and fuel relation, were stopped, and a gain of 5 tons per day was the result. These few disgressive remarks are recited here merely to show the importance of small things. There is so much in the phenomena of smelting in a blast furnace which cannot be directly observed, that it behooves every furnace manager who wishes to keep intelligent control over his charge to pay attention to all the influencing factors. The barometer and the wet and dry bulb thermometer have received practically no attention. Revolution counters are not as generally adopted as they should be. Autographic recording instruments should be used wherever available. The fact that the cost of air does not directly enter into the cost sheet is no reason why it should not receive proper attention.

Regular Temperature.—Neilson's invention of the hot blast stove was, no doubt, the greatest single step taken in advance in the process of smelting iron in the blast furnace. Every 100 degrees of heat added to the temperature of the blast is equivalent to 3 percent of the carbon burned at the tuyeres. To what degree it is practical and economical to carry the heat of the blast is still an undetermined question. Sir Lothian Bell came to the conclusion, derived from his famous investigation of the chemical phenomena of the blast furnace, that not much could be gained after reaching 1,000 degrees; nevertheless, they are today carrying at his own furnaces as regularly as possible from 1,400 to 1,500 degrees at the Clarence Works. In Germany, 1,500 to 1,600 degrees of blast temperature are not uncommon. In this country the average blast temperature does probably not very much exceed 1,000 degrees. Some furnace managers would like to carry higher temperatures if they could get them; others contend that high blast temperatures invariably lead to trouble. Theoretically, the limit of blast temperature is not reached until the fuel displaced by the heat of the blast has reduced the quantity to such an extent that the CO formed is insufficient in quantity to reduce the ores carried. The blast furnace cannot be successfully worked on heat alone. A sufficient quantity of reducing agent must be supplied as well, and there must be enough solid fuel to fulfil its physical function. The introduction of the regenerative hot blast stove was a great improvement over the iron pipe stove in so far as enabling higher temperatures to be obtained; at the same time, it brought with it the very detrimental factor of variability of temperature. The loss of temperature in an hour's blowing, which is the almost universally adopted period, is rarely less than 200 degrees and not infrequently reaches 300 degrees and more. Since 100 degrees blast temperature are equal to 3 percent of the fuel burned at the tuyeres, we see that these variations amount to from 6 to 10 percent of fuel in the hearth. With thoroughly purified gases the hot blast stoves can be so constructed that they will yield a blast of very high and practically uniform temperature, which can then be readily tempered down to any degree desirable. So long as iron masters persist in using dirty gases, there is little chance of improving the hot blast stove. The only thing to do is to make them bigger and build more of them. The money put into new and enlarged hot blast stoves would nearly, if not quite, pay for an installation of gas washing plant, which would produce much more economical and satisfactory results; as the blast can be readily kept at a uniform temperature by the introduction of cold blast. To do this, however, it is absolutely necessary to know the blast temperature. To have control of the heat, it is not sufficient to test the temperature once an hour, but you must be able to see what the temperature is at any moment, and what is even more important to have an instrument which is absolutely beyond the control of the man responsible for the temperature. An autographic record is of the greatest value. Without a positive knowledge of the temperature carried at all times, intelligent heat regulation is impossible and perfect control out of the question.

Composition of Blast.—There are few, if any, furnace managers not aware of the fact that humidity is an important element in the blast. Very few have taken the pains and the trouble to determine what this factor amounts to quantitatively. During the period referred to above, the author made hygrometric determinations and was surprised to find that the quantity of water carried into the furnace by the blast during the humid summer months amounted to tons of water in twenty-four hours. It is not uncommon for the air to contain 8 grains of moisture per cu. ft. At this degree of humidity a blast furnace taking 35,000 cu. ft. of air a minute will, therefore, receive

$35{,}000 \times 8 \div 7{,}000 = 40$ lb. water vapor per min., or 2,400 lb. per hour, or over 28 net tons in twenty-four hours. Since that time (1886) the author has persistently advocated the economical importance of removing this moisture from the blast, and the process of refrigeration as the best method for removing it. Knowing the amount of moisture going into the furnace with the blast, it is easy to figure the fuel required to neutralize its chilling effect. Making this calculation, we find that one pound of moisture requires in round numbers 1.3 lb. of carbon to be burned at the tuyeres to replace the heat absorbed by the decomposition of the water vapor. This, in itself, amounts to a very considerable quantity of fuel during the summer months, yet it is less than 25 percent of the actual fuel saved, as demonstrated by Mr. Gayley's desiccating plant.

The strictest attention is paid by every furnace manager to guard against water getting into the furnace through leaky tuyeres or cooling plates, yet absolutely no regard is given to the contamination of the blast by avoidable moisture. Innumerable steam leaks are often allowed to exist in the engine room, nearly all of the steam from which is car-

ried into the furnace without any idea of the fuel necessary to overcome this extra moisture. So long as these leaks do not become positively annoying to the engineer, they are rarely attended to. One instance in the writer's experience may be permissible to illustrate. At the plant in mind the blowing engines and pumps were in charge of the master mechanic of the works, over which the furnace manager had no authority. Repeated requests to repair the leaky joints were ignored. Hygrometric tests of the blast showed that it contained between 5 to 7 grains of moisture per cu. ft. above the outside atmosphere. Calculations based on this moisture content laid before the general manager brought the necessary pressure upon the master mechanic. The steam pipes were overhauled. The effect was an immediate reduction in the fuel consumption of 150 to 200 lb. per ton of iron. Similar fuel economies might be obtained at many existing plants. Desiccation of the blast is a step in advance, second in importance only to the hot blast, and it will be as generally and perhaps even more promptly adopted.

Chemistry of the Blast Furnace.

Chemical Reactions.—Practical furnace men are, as a rule, very much in the dark as to the chemical reactions which take place inside of the blast furnace. Accurate data, both as to the temperatures existing and changes which take place in the various zones of the modern blast furnace, are entirely wanting. Such an investigation as was carried out by Sir Lowthian Bell nearly forty years ago is very badly needed to throw light on what actually takes place in a blast furnace under the materially changed conditions and methods of modern practice. Every blast furnace manager knows, of course, the nature and composition of the raw material charge at the top, and the physical condition and chemical composition of product tapped out at the bottom, and can and should know the composition of the escaping gases. And all this indicates to him more or less clearly what is actually going on inside of the furnace. But in reality all he knows with certainty is the beginning and the end. We know that all the carbon that reaches the tuyeres is burned to CO, and that this reaction is the principal source of heat by which the process of smelting is carried on, and that the CO is the all-important reducing agent. From the composition and temperature of the escaping gases we can infer the relative efficiency of the furnace. From the appearance and chemical composition of slag and iron we can tell the good or bad working condition, but of the actual chemical reactions taking place in the interior of the furnace, either as to their sequence or relative importance, we know practically nothing.

Carbon Impregnation is one of the important phenomena about which we are still very much in the dark. It had been observed before, but was first prominently brought before the iron metallurgists through the researches of Sir Lothian Bell, that sesqui oxide of iron (Fe_2O_3) possessed the property of splitting up CO into $C + CO_2$ at temperatures existing in the upper region of a blast furnace. This phenomenon has been the subject of scientific investigation by Dr. Aloys Weiskopf. All hematite ores possess this quality to a greater or lesser degree and some of these from the Mesabi range are most remarkable for their capacity to become impregnated with carbon. Experiments by O. O. Landig showed that the ores of some of the deposits became impregnated to such an extent that their volume was very considerably increased. This being so, it is more than probable that most of the difficulties experienced in smelting the Mesabi ore are due to this quality of excessive carbon impregnation.

Hanging of the stock in the upper part of the furnace is, no doubt, entirely due to this phenomena, for it necessarily follows that the swelling of the ore must increase the resistance to the gas currents and must also increase the friction against the inwall of the furnace. Now if we consider that even under the most favorable conditions, by far the greater part of the column of stock is supported by the normal friction against the inwall, and the further fact that 1 lb. of unbalanced gas pressure will sustain approximately 1 ft. in height of the column of stock, it is not difficult to understand how the downward movement of the solid material may be arrested without involving any other other factor than excessive carbon impregnation. A portion of the stock column having once come to rest, is bound to remain at rest until the cause of arrest is removed. This necessarily follows from the fact that friction of rest is greater than friction of motion, so that if there is sufficient friction and pressure developed to cause a moving body to come to rest, there is always more than necessary to hold it stationary. Meanwhile, the consumption of fuel continues at the tuyeres in accordance with the volume of oxygen forced in by the blast. The iron sponge is carburized and melted, the dross of both ore and fuel combines with the flux and is fused into a liquid slag which descends with the iron into the hearth, where they take up very little space compared with their original bulk, and from which they are tapped off from time to time. As this process of smelting goes on, that portion of the column of solid material which is free to move in the furnace shaft above continues to descend. This causes a break between the arrested and moving part of the stock column. A cavity is soon formed which continues to increase in dimension in proportion as the moving column is smelted and consumed. The shorter this column gets, the less is the resistance it offers to the ascending gases, hence, with a given blast pressure, the pressure in the cavity must also increase, thus giving the stationary column still greater support.

On the other hand, it is evident that since no cold stock enters the furnace during the period of hanging, its contents must become hotter and hotter; also that the increased temperature will accelerate chemical reaction. Reduction progresses more rapidly; the carbon deposited at the lower temperature is consumed by the oxygen, liberated from the ore which it has impregnated, or by reducing CO_2 to CO, probably both. As this process proceeds, the stationary column necessarily shrinks and finally breaks away. This phenomenon is called a slip or slipping. There are two distinct varieties of this phenomenon, the one due to causes just discussed, known as top slips, always occurring in the upper half of the stock column; and the other, called bottom slips, due to causes entirely different and always occurring in the lower part of the furnace, generally within the limits of the hearth and bosh.

A little calculation will show that the force necessary to throw a bell and hopper out of a furnace is not so great as would appear from the mere statement of the fact that they weigh many tons. A gas pressure of 1 lb. per sq. in. when applied to a circular area 12 ft. in diameter, exerts a lifting force of considerably over 8 net tons, on an area of 14 ft. in diameter of fully 11 net tons.

What pressure of gas is produced by a top slip depends on the size and the shape of the cavity developed during hanging, as well as the temperature and pressure of the gas it contains, the weight of the suspended column, and the manner in which it drops.

Let us suppose that the upper 10 ft. of the stock in a modern blast furnace becomes arrested, i. e., hang. The furnace working normally below, a cavity will form, and will increase as fast as the descending column is consumed by the process of smelting. As the descending column shortens, the resistance of the ascending gases becomes less, and since the condition of the hanging column is but slowly changing, the gas pressure in the cavity steadily increases. The same is necessarily true of the temperature since the gas passes through material which is getting hotter and hotter as it approaches the zone fusion. While the increased pressure tends to support the hanging column indefinitely, the

increased temperature stimulates chemical action, and the deposited carbon is gradually consumed. This burning out of the impregnated carbon causes shrinkage of the suspended material and finally results in its dropping into the cavity below. The hanging column drops like a solid plunger into a cavity 10 or 15 ft. deep. The hot gas will be compressed proportional to the weight and momentum of the descending mass, and the partial vacuum formed above will be filled by cooler gas rushing back into the furnace from the gas mains, mingled with more or less atmospheric air drawn in through the leaky bell and poorly fitted explosion doors. Immediately the pressure of the compressed gas is sufficient to overcome the resistance offered by the plunging stock column; it breaks through with force and instantly mixes with the cooler gases above, raising them suddenly to a high temperature, which may be very materially augmented by the instantaneous combustion of the oxygen present, resulting in a pressure sufficiently sudden and high to produce effects akin to real explosions. The author is not aware that the presence of these so-called "explosions" have ever been measured, but it is doubtful whether they often exceed 10 or ever reach 15 lb. per sq. in.

It must not be supposed that top slips always take place in the extreme manner of our hypothetical case. Generally the hanging stock drops into the cavity below less suddenly, the phenomena lasting over many seconds and sometimes minutes; nevertheless, considerable quantities of fine ore and coke are thrown out with every slip, and not infrequently large quantities of the coarser material, especially coke. The large furnaces, working principally on Mesabi ore, apparently work by slips only. It is the exception rather than the rule that twenty-four hours pass without appreciable slipping. There is one feature about these phenomena which, since their destructive effects have been overcome by structural improvements, makes them less objectionable than would at first appear. The real process of smelting is but very little, if at all, disturbed by them. It it were not for this fact, top slipping would have become intolerable long ago. As it is, large output and acceptable quality are still attainable. Top hanging and slipping seems to be attributable to two causes, the inherent condition of the ore, and over-exposure. The first can be mitigated by judicious selection and admixture of the ores and proper charging, and the second cause can be largely, if not altogether, avoided, by smelting these ores in furnaces better adapted to their requirements. The modern excessively high furnace is an absurdity when we consider reducibility and other properties, both physical and chemical, of the ores smelted in the majority of them.

Bottom Slipping.—Bottom slipping is a phenomenon quite different from top slipping, and it is due to entirely different causes. Bottom slipping occurs entirely within the zone of fusion and is chiefly caused by temperature variations due to direct variations in the blast temperature, the irregular moisture content, and to changes in the carbon content in the fuel. Irregularity in the composition of the slag aggravated by temperature changes is probably the most prolific cause of hanging and slipping in the lower part of the furnace. Excessively basic slags are more inclined to build up than acid slags. High alumina slags are especially bad. Bottom slips invariably spoil one or more casts of iron, and not infrequently block up the hearth and tuyeres to such an extent with a cold refractory conglomerate of partially reduced iron, slag, carbon dust, lime, and fine coke, that heroic means are required to get the furnace into proper shape again. Not more than a generation ago these bottom slips very often proved fatal to the campaign, or at least required days of sledging and drilling, to get the blast properly into the furnace and the molten iron and slag away from it. The introduction of the oil blowpipe proved itself of great assistance to the troubled furnace manager, and latterly the electric arc makes playwork out of the task of opening up frozen tuyeres and chilled iron and cinder notches, compared with the sledge and chisel of the olden days.

Scaffolding.—When the accumulations which give rise to bottom slipping, become chronic, we have scaffolding. There can be no doubt that all scaffolding starts in the zone of fusion, and is due to the causes that give rise to bottom slips. If that is true, what would prevent the latter, would make the former impossible. Whether these disturbances can ever be entirely overcome may be questioned, yet there is still so much room for improvement in furnace practice, *e. g.*, in the preparation of the ore and flux, the selection of the fuel, the manner of charging, uniform blowing, desiccation and regular heating of the blast, etc., that many of the troubles now of still too frequent occurrence may be almost if not entirely eliminated.

Mechanical Conditions.

Distribution.—While much has been done to overcome the inherent tendency of the skip-hoist to distribute the coarse and fine ore unequally, and much improvement has been made, the charging device that will distribute all the different kinds of material satisfactorily has not yet been invented, or, if invented, has yet to demonstrate its practicability and effectiveness. The ideal charging apparatus, in addition to fulfilling the paramount requirements of being strong, durable, and forming a perfect gas-seal, should be under such control of the man in charge that the material charged, irrespective of its physical condition, can be distributed from the hopper evenly over the entire area of the furnace or practically in a ring against the outer wall, all in the center, or in intermediate circles, or, if need be, in a heap in any desired point of the compass. With such a charging apparatus many of the difficulties would be entirely avoided, and irregularities in the settling of the stock could be speedily remedied. Such a charging apparatus should be supplemented by an automatic stock-level indicator. The bell and hopper which fulfills the first three requirements perfectly, falls far short as a distributor because of its narrow limitations and inflexibility especially in connection with the automatic skip-hoist.

All the ores should be separated into at least two classes physically, viz., coarse and fine. At hand-filled furnaces this can generally be accomplished without special apparatus, and the stock can be charged into the furnace in accordance with any method the manager may desire, within the limits of the apparatus, which allow great variation, and in this way much can be done to secure uniform working, provided there is sufficient intelligence and vigilance available on the stock-house floor.

The Barrows' Method of Charging.

This method was described by Mr. Barrows Jr., and may appropriately be called heterogeneous charging. Assuming that the ore mixture consisted of 25 percent of magnetic concentrates, 25 percent of fine hematite, 25 percent of coarse hematite and 25 percent of coarse magnetite, and that a round of ore consisted of 12 barrows. On this assumption (using the points of the compass for convenience of explanation) the charging would proceed as follows: The coke charge having been lowered into the furnace, then, starting in the north, fill 3 barrows of concentrates side by side, in the northeast quarter; next 3 barrows of coarse hematite, in the southeast quarter; then 3 barrows of fine hematite in the southwest quarter; completing the round with 3 barrows of coarse magnetic ore in the northwest quarter of the hopper. The next round would start in the east with 3 barrows of concentrates above the coarse hematite, next 3 barrows of coarse magnetic ore over the fine hematite, then 3 barrows of fine hematite over the coarse magnetic ore, closing with 3 barrows of coarse hematite over the concentrates. Thus getting every ore into every part of the furnace in regular routine, the coarse and fine ores alternating both as to their vertical and horizontal relation. The main object of this method of filling being to break up the continuity of the gas currents and thus prevent

channeling, reduce flue dust and obviate irregularities in general. It is applicable to all hand-filled furnaces, and could be adopted with advantage by all furnaces having to smelt ores differing very much in degrees of fineness.

Uehling's Method of Charging.

Prior to the advent of the closed furnace tops it was the universal practice to mix the fuel and its burden as much as possible. Every barrow of fuel was invariably followed by a barrow carrying its quota of ore and flux. This method was continued as much as possible after the general adoption of the bell and hopper. At the works in Sharpsville, Pa., where the author first made his acquaintance with the blast furnace, in 1879, the fuel charge consisted of 2 barrows of block coal of 500 lb. each, and 2 barrows of coke weighing 300 lb. each, a total fuel charge of about 1,600 lb. The 2 barrows of coal were dumped into the hopper opposite, and the 2 barrows of coke into the gaps left between them. Four barrows, of which each carried its proportion of ore and limestone, were dumped over the fuel and all were lowered into the furnace together, thus mixing fuel and ore as much as possible. After studying "Bell's Phenomena of the Blast Furnace," and particularly "Gruner's Analytical Studies of the Process of Smelting," the author came to the conclusion, based entirely on theoretical reasoning, that it was all wrong to mix the ore and fuel in charging a blast furnace; that, on the contrary, they should be separated as much as possible in order to obtain the best results. Briefly, the method of stratified charging consists of filling the fuel and ore in separate layers. The fuel charge should be as heavy as is consistent with the size of the furnace, forming a uniform strata not less than 2 ft. deep. In a furnace over 80 ft. high, preferably deeper, the ores should be filled on the fuel in strata, beginning with the coarsest and ending with the finest. The limestone, being coarse, should go on top of the strata of coarse ore. It should be kept, as much as possible, from coming in direct contact with the fuel. Different ores of the same degree of fineness should be charged with regard to their capacity for carbon deposition. In how far the method of charging above briefly outlined can be carried out in practice, depends on local conditions, which would have to be studied on the premises in each case. It may safely be said, however, that there are few furnaces, the running of which could not be very appreciably improved by the application of stratified filling. It can be carried out equally well by hand or any of the approved automatic filling devices.

Utilization of the Gas.

Gas.—The blast-furnace gas is a most important factor in the process of smelting not only inside, but also outside of the furnace. Inside of the furnace it distributes the heat and reduces the ore to the metallic form. How well it performs these functions can always be ascertained from its temperature and chemical analysis. The first symptoms of irregularities in the process of smelting manifest themselves in the gas. A continuous record of the CO_2 would be of the greatest value to the observant blast-furnace manager. The continuous autographic record of the gas temperature has been found by those who give it attention to be an invaluable aid in diagnosing irregularities in the working of the furnace. Every furnace man knows that a hot top is indicative of a cold bottom. This will be readily understood from the fact that 100 degrees of heat in the escaping gas is equivalent to over 4.25 percent of the heat generated by the fuel burned at the tuyeres. Thus, an indirect fuel loss of from 10 to 15 percent may easily take place unnoticed until four or six hours later sharp cinder and inferior iron reveal the fact that something went wrong. In addition to revealing internal conditions of the furnace, the autographic gas temperature record indicates the charges that go into the furnace, both as to time and number, and is, therefore, a most valuable check on the stock-house operation. In a paper, entitled "The Blast Furnace as a Power-Plant," the author endeavored to show by simple process of calculation that under conditions of best average fuel consumption, viz., 2,000 lbs. of coke per ton of iron, and proper treatment and utilization of the gas, there would be a surplus of at least 800 h. p. per ton of iron produced per hour. Or, in other words, a blast furnace of a daily capacity of 250 tons, or, in round numbers, 10 tons per hour, should have a surplus of gas over and above all furnace requirements, sufficient to generate 8,000 h. p. in any of the available types of large gas engines. Other investigators, notably B. H. Thwaite, who is the pioneer in the field of direct utilization of blast-furnace gas in the gas engine, have come to similar conclusions. Since publishing the above calculations, the author has had opportunity to investigate the blast-furnace gases at a number of the large iron and steel plants, and has found that his figures were very conservative; that from 1,000 to 1,200 h. p. is nearer the actual surplus.

From 45 percent to 50 percent of the heat value of the fuel used in the process of smelting in the blast furnace is contained in the escaping gases, of which 35 percent should be sufficient to heat the blast and produce the power to run the furnace and all its mechanical accessories. In spite of this enormous theoretically demonstrable surplus heat energy, the fact remains that, at the majority of the blast-furnace plants, hundreds of tons of coal are burned annually to assist the gas in generating the necessary steam for the power required, and it is the exception rather than the rule that the desired blast temperature can be regularly obtained from the stoves, notwithstanding the fact that both stoves and boilers have from time to time been increased both in size and number. The sole reason of this deplorable condition is due to the fact that the uncleaned gas cannot be efficiently utilized. It is just as irrational to burn the impure gas as it would be to attempt to burn coal mixed with all the slate and rock that is dug and raised with it from the mine. The partial purification employed at the majority of plants in the dry way is based on irrational methods and carried out by primitive and inadequate means, and rarely more than the coarsest of the flue dust is separated from the gas. The attempts at washing are generally carried out by half-way methods, which, although they remove much of the finer dust, are liable to contaminate the gas to such a degree with moisture that the harm overbalances the good accomplished. The subject of gas purification is the most important problem before the blast-furnace manager and engineer today. Even if we leave out of sight the value of the surplus gas for power purposes, the saving in extra boiler and stove equipment, in wear and tear on the latter, in time lost directly and indirectly because of stoppages for cleaning, inadequate steam and heat, coal burned, and cost of labor for cleaning stoves and boilers, etc., etc., would more than justify the cost of a gas-washing equipment that would properly cleanse the gas.

The *Literary Digest* says that in a recent talk to the students of the Iowa State College, Robert Quayle made the statement that if one of the best football players in first-class training were placed on a large locomotive for a long trip, it would tax his physical powers a great deal more than would the playing of an end position on a football team. He went on: "I might say that if he had, on a good hard winter's night, to shovel, in the course of five or six hours, about fifteen tons of coal through an 18-in. hole, and were it possible to see that fifteen tons piled up before him and he was told that he would have to put in that coal in five or six hours, I think he would quit his job before he tackled it."

The Michigan Sprocket Chain Co., Detroit, Mich., has changed from a limited company to a corporation, incorporated under laws of the state of Michigan. Capital stock, $50,000.00 The officers are: T. H. Simpson, president; Geo. M. Black, vice president; L. B. Ball, treasurer and manager; E. L. Nelson, secretary; F. C. Thompson, assistant treasurer.

INDUSTRIAL SUMMARY.

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

New Buyers in the Market and Some of Their Wants:—

The Clarksdale Machinery, Supply & Mfg. Co., of Clarksdale, Miss., has been incorporated with a capital of $10,000 and will erect a two-story building 50 by 100 ft., to be used as a foundry and machine shop.

The Demopolis Foundry & Machine Co., of Demopolis, Ala., has been incorporated with a capital of $50,000. The incorporators are A. R. Smith, L. W. Spalding and W. M. Spencer.

H. L. Maxfield, Norman Carle and others, of Janesville, Wis., have organized a company to build a $20,000 foundry for producing gray iron castings.

The Foster Mfg. Co., of St. Louis, Mo., has been incorporated with a capital of $50,000 to manufacture and deal in stoves. The incorporators are: Robt. M. Foster, S. Lowry, of St. Louis; T. J. Mitchell, of Helena, Ark.; and R. P. Martin, of Jonesboro, Ark.

The Conner Brake Shoe Foundry, with a capital of $15,000 to $20,000, is about to be organized by Theo. F. Conner, of Bloomsburg, Pa. Mr. Conner is now building a foundry plant and is organizing the new company to increase his capital and be able to handle large orders anticipated.

Geo. J. Markley, Mineral City, O., is in the market for an air compressor and pick mining machines.

The Lorain Sand & Gravel Co., Lorain, O., has been organized with G. M. Ferguson as president and G. A. Resek secretary.

The Dayton Hydraulic Machinery Co., Dayton, O., has been incorporated, capital, $300,000, by Frank L. Canby, Willard D. Chamberlin, Albert Thresher, Wm. F. Chamberlin and D. D. Ozine.

Articles of incorporation have been filed by the Hampden Double Combustion Furnace Co., with a capital stock of $5,000. The incorporators are: W. R. Hampden, Alfred F. Wheelan and Francis E. Montee, all of Kansas City.

The Cincinnati Forging & Smithing Co., Cincinnati, capital stock $4,000, has been incorporated by Henry Lindenburn, Herman Gausing, W. A. Rest, H. C. Taylor, Walter A. Knight and others.

The Pederson Multi-Piston Co., Superior, Wis., has been incorporated to manufacture machinery; capital, $100,000; by P. C. N., A. J., Fred, James E. and Arthur B. Pederson.

The Galion Metallic Vault Co., Galion, O., recently incorporated, hopes to commence operations within 60 days. A committee has been appointed to prepare a list of machinery and tools necessary, and obtain prices.

Reedy Foundry Co., Chicago, has been incorporated; capital, $50,000; foundry and machine shop business; incorporators, W. H. Reedy, W. E. Wakefield and Joseph Price.

New York Tool Co., New York, has been incorporated; capital, $25,000; directors, John D. Gould, Herbert D. Montgomery and Henry L. Washburn, New York.

Interstate Steel & Iron Co., Brooklyn, N. Y., capital, $10,000, has been incorporated; directors, John B. Cranthorn, of Richmond Hill; Charles Watson and Paul W. Smith, of Brooklyn.

Niagara Imperial Machinery & Novelty Co., Lockport, N. Y.; capital, $300,000, has been incorporated; directors, W. E. Randall, Tonawanda; C. C. Eggleston, Lockport; Howard Hall, Decatur, Mich.

The General Electric Co. is in the market for a large list of tools to be used in the new static transformer department.

The Standard Roller Bearing Co., Philadelphia, intends to purchase, within the next three months, a number of lathes and milling machines. The Old Dominion Iron & Nail Works, Richmond, Va., will purchase mechanical equipment, including boilers, Belgian train or rolls, two spike machines, one lathe and two waste heat furnaces. The McKay Carriage Co., Grove City, Pa., will purchase drills, power hammers and other machinery.

Among the largest prospective purchasers of general machinery is the B. T. Babbitt Soap Co., of Nos. 64-84 Washington street, N. Y., which has completed its plans and is now calling for bids on the construction of a new and extensive plant in Granton, N. J. The company will soon require a very large quantity of material, including the necessary electrical apparatus for lighting purposes and for driving the machinery. In the power plant, an additional 500 horsepower of engines, two 150-kilowatt generators, motors and appurtenances will be installed.

A considerable quantity of mechanical apparatus will also be needed soon for the new sand filtration plant which is to be built by the Department of Public Works of Pittsburg at a total cost of $5,000,000. Four condensing pumping engines will be required, each having a capacity of 35,000,000 gallons in 24 hours, and four condensers and air pumps, each condenser being capable of maintaining a vacuum of at least 27 inches. A circulating pump for furnishing the cooling water, with a capacity of about 4,000 gallons a minute will also be needed. The remaining contracts will be for eight water tube boilers, each equipped with mechanical strokers and two fuel economizers two 5,000,000-gallon wash water pumps, one 3,000,000-gallon pump, three direct current generating sets, one motor driven arc light generator, nine miscellaneous small pumps, one switchboard, one electric traveling crane, one 24-inch engine lathe, one 12-inch engine lathe, one 10-inch lathe, one 10-inch pipe machine, one 25-inch upright drill press, one 24-inch shaper, and all the necessary shafting, pulleys, etc.

The Detroit Southern Railroad Co. will soon purchase a few new machines for the locomotive department of the proposed new shops. New boilers and engines will be needed by this road for installation in its power house.

The Delphos Can Co., of Delphos, O., is now purchasing machinery which, when installed, will more than double its present capacity for manufacturing oil cans.

The United States Hoe & Tool Co., of Columbus, O., which was recently organized with a capital stock of $150,000, is in the market for the entire equipment for its new plant, including presses, hammers and lathes.

The Carlisle Body & Gear Co., of Carlisle, Pa., needs a complete equipment of machinery such as is used in the building of bodies and gears.

Special tools will soon be purchased by the Brantley Mfg. Co., of Birmingham, Ala., for use in its new plant, which is being built for the manufacture of alternating steel gin brushes, cotton ginning and cotton seed machinery.

The charter of incorporation of the Clarksdale Machinery & Supply Mfg. Co., Clarksdale, Coahoma Co., La., has been filed with the governor for approval. Capital stock, $10,000. The incorporators are: H. J. Davis, Earl Brewer and others.

The Mereen-Johnson Machine Co., Minneapolis, Minn., has been incorporated with a capital stock of $25,000. The incorporators are: Arno Mereen, C. A. Smith, Victor T. Johnson and Charles Johnson.

The Dillon Iron Foundry, Dillon, S. C., has been organized, and the following were elected directors: J. D. Haseldon, chairman; T. B. Stackhouse, J. W. Moore, Dr. J. H. David, T. G. King, J. H. Hamer, T. A. Dillon. The president will be elected at the next meeting of the directors, which will be held next week.

Fires and Accidents:—

Fire last week in a 5-story building at Broadway and Thomas street, New York, caused a loss of $10,000. The blaze originated in the repair shop of the Monarch Type-

writer Co., third floor, and it was there that the principal loss was sustained.

By terms made between E. H. R. Green and the citizens of Terrell, Texas, the Texas Midland shops, which were destroyed by fire last November, will be rebuilt at Terrell.

The Crawford-Speer Foundry & Machine Co.'s plant, Bridgewater, Pa., was destroyed by fire Feb. 15. Loss $9,000. Insurance $4,000.

Carelessness on the part of an employe who dropped a lighted match on a turpentine-soaked floor in the Gibson building, at 25 and 27 N. Clinton street, Chicago, Feb. 11, resulted in a fire which damaged the structure and contents to the extent of $60,000. All of the floors of the building, which is a 6-story structure, were occupied by the Gibson Spring Co., save the second floor, which was occupied by the Anderson Machine Co.

A japanning oven on the works of the Columbian Hardware Co., Cleveland, exploded at the noon hour, Feb. 17, injured two employes and completely wrecked the japanning building, causing a loss of $8,000.

The iron and brass foundry of H. H. Clay and H. E. Olbrich, Cedar Falls, Ia., was destroyed Feb. 13. Loss $20,000. Insurance $4,000.

Fire at the Stanley G. Flagg & Co.'s works, Pottstown, Pa., Feb. 11, destroyed the foundry and core house. Loss, $10,000.

The forging room of the Union Drop Forge Co., Chicago, was damaged by fire Feb. 13. Loss, $8,000, fully covered by insurance.

The plant of the Detroit Steel Casting Co., Detroit, was destroyed by fire Sunday morning, Feb. 19. The loss, amounting to over $100,000, is covered by insurance. The firm's full force of 250 men were thrown out of employment, a number of them losing their tools, upon which no insurance was carried. The work of rebuilding will be begun at once, and a small force may be at work within ninety days, but the entire plant will probably not be in operation for eight or nine months.

Fire originated in the finishing shop of the Barney & Smith car works, Dayton, O., Feb. 20, destroying that building, valuable lumber and six practically completed express refrigerator cars. Loss, $60,000.

The Doherty Organ Co.'s machine shop at Clinton, Ont., was destroyed by fire Feb. 15. Loss about $50,000. The company will rebuild as soon as possible.

New Construction:—

The Aurora Foundry Co., of Aurora, Ill., is planning to build several new buildings, including a pattern shop which will be 30 by 60 ft.

The Dana Mfg. Co. has purchased five acres at Norwood, Cincinnati, O., and expects to erect several buildings, including a foundry.

Contracts have been let for the enlargement of the Western Foundry Co.'s plant of Chicago, Ill. The addition will be 70 by 100 ft.

The Hartford Machine Screw Co., Hartford, Conn., is now running 12 hours a day and is building an addition to its plant. A great deal of work is being done in designing and building special automatic screw machinery.

The Toledo Club is investigating the advisability of organizing a company to build a steel plant at Presque Isle, near that city. A committee from the club, a few days ago, visited the Illinois Steel Co.'s plant at South Chicago. Ralph L. Morgan is the principal promoter of the new enterprise.

The Erie Railroad Co. has decided to expend $150,000 on extensions, improvements and repairs to its large repair shops at Hornellsville, N. Y.

It now seems probable that as a result of the recent fire at the shops of the B. & O. Railroad at Lorain, the greater part of the locomotive department will eventually be established in other plants of the company. A new roundhouse will probably be built at Lorain, and some repair work will be done at Lorain shops; but it is expected that the most important of the repair work will be done elsewhere.

The Quincy Stove Mfg. Co., of Quincy, Ill., has decided to build an addition to its foundry during the coming year. It has elected the following officers for the ensuing year: President, August Heidbreder; vice president, Nicholas King; secretary, Julius Klemme; asst. secretary, Chas. Heidbreder; treasurer, H. C. Sprick.

Preliminary steps looking to the establishment of a steel shipbuilding industry at Halifax, N. S., have been taken. The Shipbuilding & Investment Co. has been organized and has secured a favorable site on the water front.

The Sonora Foundry, of Hermosillo, Sonora, Mexico, has been started recently, with Jose H. Aguilar as manager. Mr. Aguilar was educated at the Massachusetts Institute of Technology and has had shop experience in the United States. He will have a well equipped foundry and machine shop.

The Jewett Stove Co., Tonawanda, N. Y., has commenced the construction of the foundry which it expects to have in operation by May 1.

The citizens of Woodburn, Ore., have raised a cash bonus and given a building site to John McKinney, of Bremen, Ind., to induce him to erect a foundry at Woodburn, Ore.

Eugene Victori & Sons, of Jersey City, N. J., are erecting a new work shop and foundry.

The Hartwell Iron Works, of Houston, Tex., are making extensive additions to their plant.

The Southern Skein & Foundry Co., of Chattanooga, Tenn., has completed the plans for two buildings, one of which will be 75 by 200 ft. and the other 75 by 125 ft.

Herzler & Henninger, of Belleville, Ill., are planning to add a foundry to their plant.

Wm. E. Pratt Mfg. Co., Joliet, Ill., has purchased land adjoining its plant, and will immediately begin the work of enlarging the plant. The company was organized three years ago by Wm. E. Pratt and its growth has been rapid.

It has been practically decided to rebuild the Rome Merchant Iron Mill, Rome, N. Y., recently destroyed by fire.

The Carroll Barb Wire & Fence Co., Peoria, Ill., has had plans prepared for its new plant, and is looking for a site.

Work has been begun on the erection of the new structural iron works which will be built by Chas. Hanika at Muncie, Ind. It is expected that the plant will be ready for operation by Aug. 1.

Plans are being prepared for a new foundry which will be built as an addition to the plant of the Stacey Mfg. Co. at Elmwood Place, Hamilton Co., O.

Tredegar Iron Works, Richmond, Va., whose plant was recently damaged by fire, will make repairs so that the operation of the plant can be continued without delay.

The Galena Iron Works Co., Galena, Ill., will build a plant at Platteville, Wis., to operate in connection with the plant at Galena. The size of the plant has not been determined.

The Houghton Elevator & Machine Co., Toledo, O., has increased its capital from $25,000 to $125,000, and will increase the size of its plant, installing considerable new machinery.

The Turner Heater Co., Bristol, Conn., will rebuild the plant recently destroyed by fire. Considerable new machinery will be required.

The Pratt Chuck Co., Frankfort, N. Y., expects to erect new buildings in the spring to meet the demand for its product. The company has recently installed considerable new machinery.

The Frank C McLain Co., 264 Fourth avenue, New York, recently incorporated, has not yet completed its plans, but it expects to build a plant near New York, probably in New Jersey, to manufacture boilers, radiators, tanks and supplies.